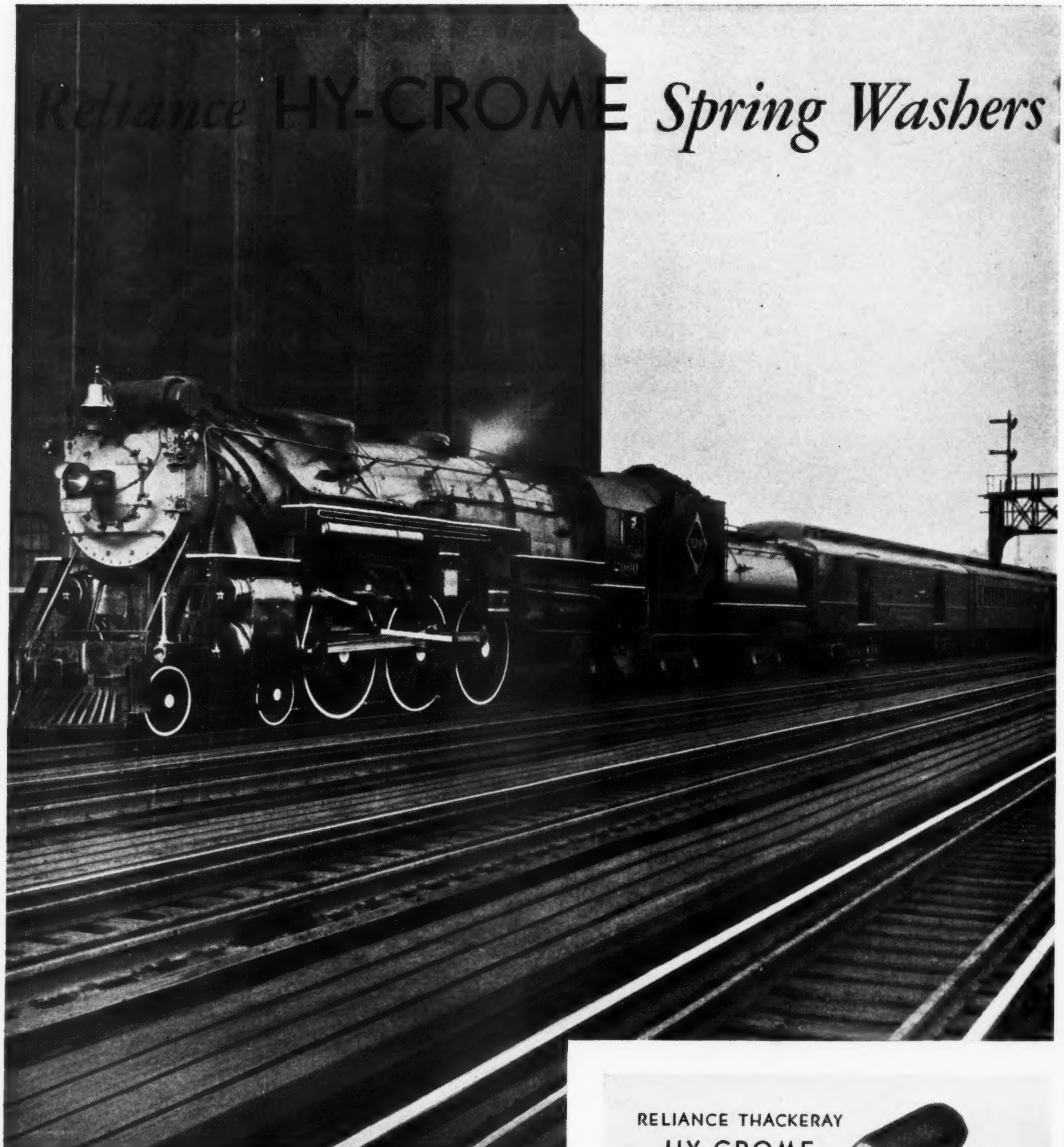
Railway Engineering and Maintenance

February, 1934

Reliance HY-CROME *Spring Washers*



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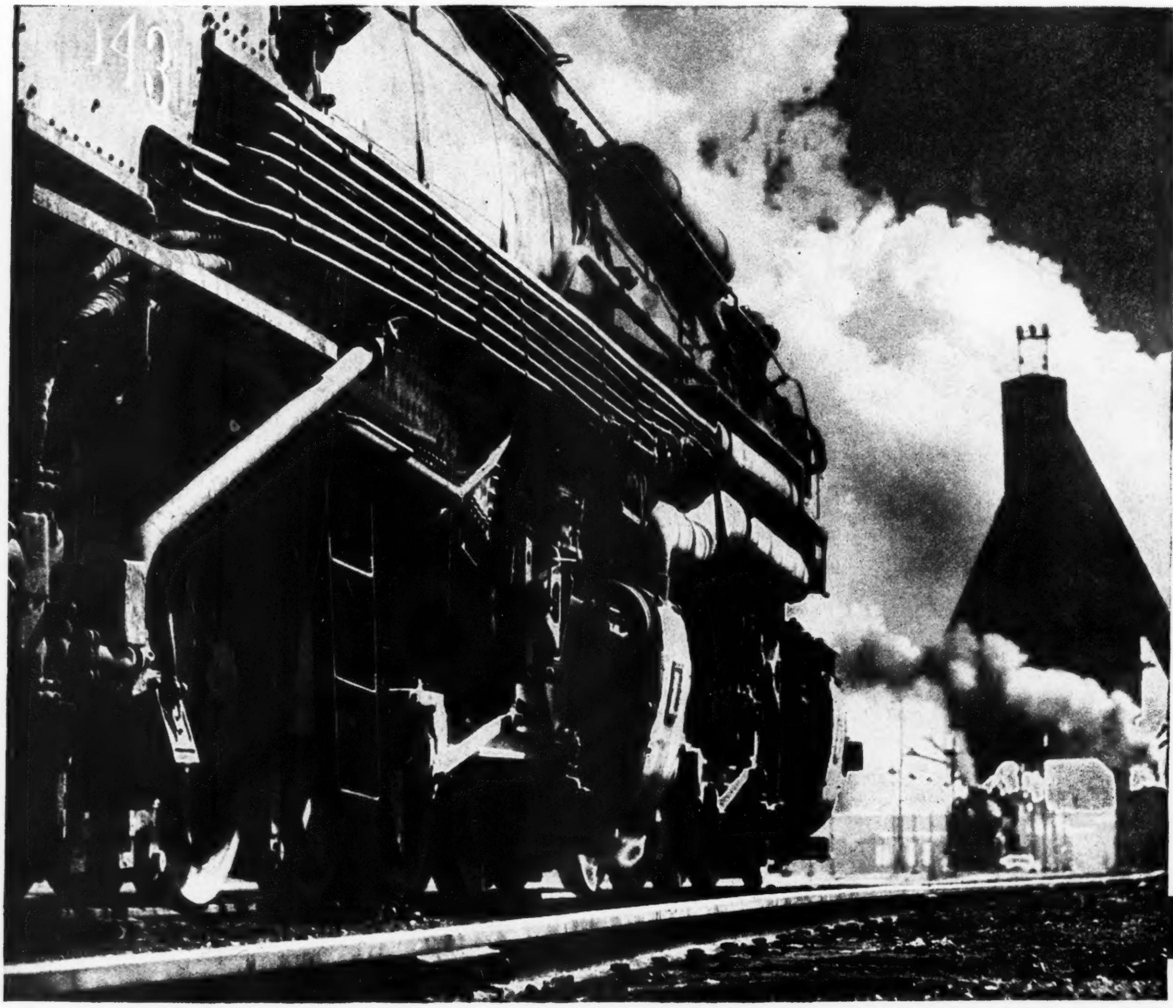
Are You Preparing a New

★ In spite of excellent management most railroads have fallen behind on their maintenance work.

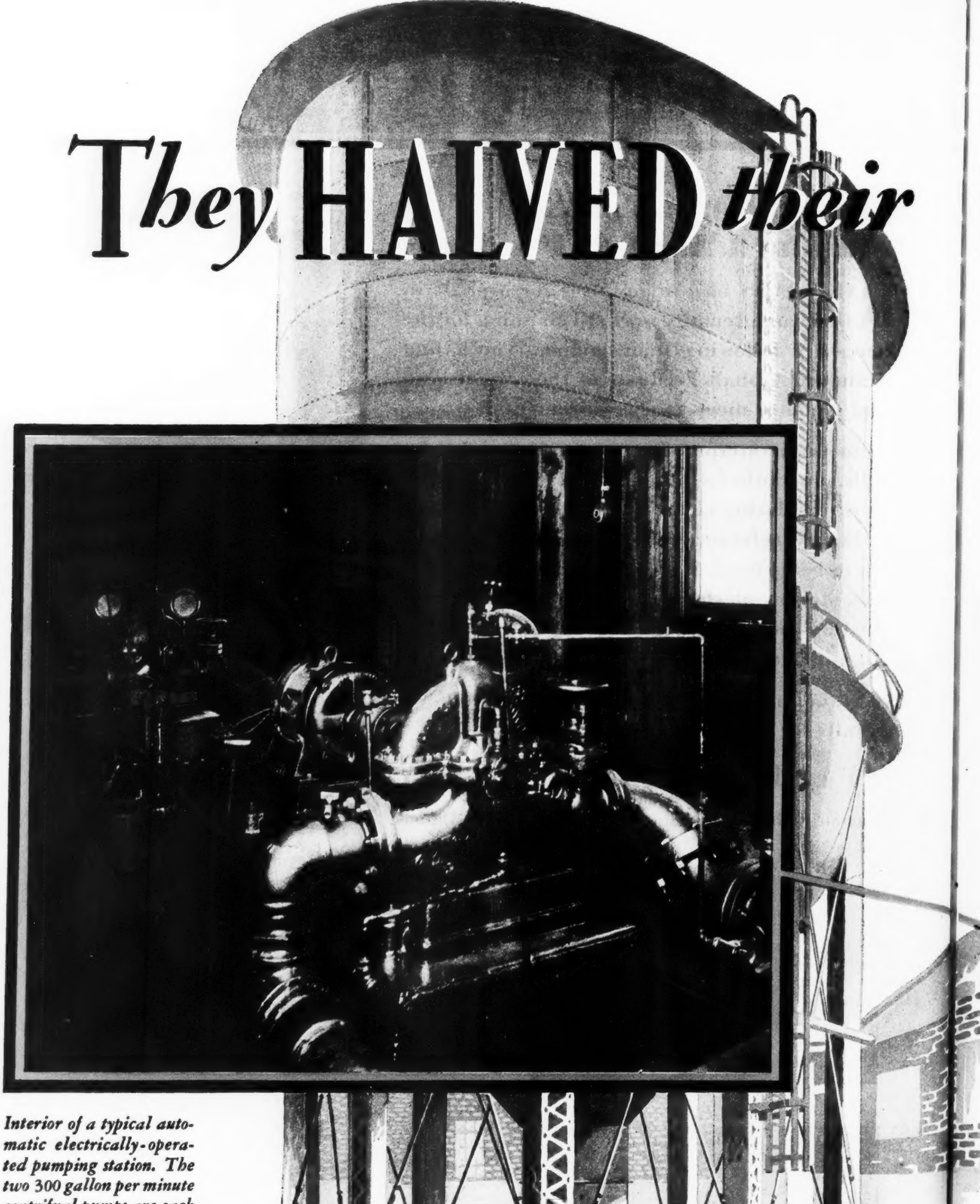
★ Present increase in rail traffic and future outlook make adequate maintenance necessary.

It is evident that, even after making full allowance for the decreased traffic, there is a deficiency of at least a full year's normal maintenance work. Time plays havoc with bridges, buildings, road beds, ties, etc., that do not receive adequate maintenance.

With car loadings showing substantial improvement and future prospects looking brighter, many railroads are giving more attention to maintenance. The first available money, in many cases, has been directed toward the smaller necessary maintenance work.



They HALVED their



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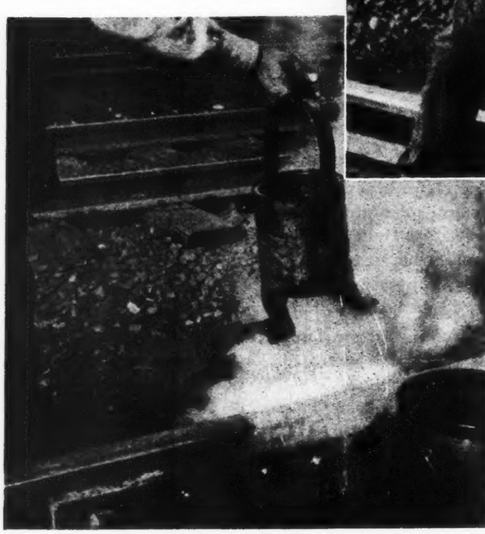
Above: Heating the rail ends with AIRCO-D-B Style No. 9800 Oxyacetylene Torch.

Above: Using pyrometer to determine correct quenching temperature.



At left: Quenching rail ends.

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Railway Engineering and Maintenance

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FEBRUARY, 1934

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Railway Engineering and Maintenance

POOR SPORTS

Highway Carriers Wail When Tables are Turned

THE American public has long been noted for its love of fair play. Conversely, it has shown little sympathy with a contestant who cries out when given the same treatment that he has handed an adversary. It is in the latter position that the motor bus and the motor truck operators have recently placed themselves. It is the latest of a series of developments that are of vital interest to every railway employee by reason of the relation it bears to the security of his position.

The Motor Bus Situation

This situation has been precipitated, so far as the motor bus operators are concerned, by the action of the railways in the south and west in drastically reducing their rates. In taking this action, these railways have met the bus operators on their own ground. While the highway carriers have offered frequency of schedules and certain other conveniences as arguments for patronage, their most effective weapon in attracting traffic from the railways has been their lower fares. To many persons, especially of late, comfort, dependability and other attributes of train travel have been secondary to that of cost. The buses have catered to this condition, placing their fares below those of their railway competitors and emphasizing this discrepancy. It is the difference in rates, more than all other influences, that has attracted some 350,000,000 passengers to the buses annually.

It is this competition of lower rates that the railways in the south and the west are now meeting, while the roads in the east are considering similar action. By reducing their rates to levels ranging from 1½ to 2 cents per mile for coach travel, the railways have dealt a very severe blow to the buses, for they have taken from them their principal bid for patronage. That the bus operators realize the menace of this action to their future is evidenced by the frantic appeals that they have made to the President, to the Interstate Commerce Commission, and to General Johnson of the N.R.A. The irony of their position is indicated by their appeal for intervention in the "campaign of passenger rate cutting that the railways have started," ignoring the fact that the entire history of bus transportation has been one of rate cutting and that their entire business has been built on the traffic that they have been able to develop by reducing their rates below those charged by the railways.

It is an illuminating commentary on the inconsistency of the motor operators' position that in their desperation they have turned to the Interstate Commerce Commission with the request that the commission prevent the railways from meeting the competition which the bus operators have themselves created and which they have conducted free from any control or supervision by the commission. In other words, having raided at will through the most ruthless and unregulated competition the traffic which the railways have built up through a long period of development, the highway operators now ask the Interstate Commerce Commission to "protect" them in their plunder and to prevent the railways from taking such means as are lawfully theirs to recover the traffic which they are best able to handle.

The Motor Truck Protest

A similar situation has developed among the motor truck operators, following the inauguration by several eastern roads of storedoor pickup and delivery service by trucks of their own selection. Speaking on behalf of the truck operators, the American Trucking Associations, Inc., has appealed to Federal Co-ordinator Eastman to prevent the railways from entering into "cut-throat competition." Like the plea of the motor bus operators, this petition is illuminating in its appeal for protection from a practice which it initiated and has followed without restriction up to the present time.

These "squeals" are only one of several evidences of the changes that are occurring in the relations between the railways and highway transport agencies in their competition for the transportation business of the country. The wave of legislation for the control of the heretofore unregulated traffic on the highways and the monopolization of these public highways by private bus and truck operators is by no means spent but will be further extended this winter as public sentiment crystallizes still further before various state legislatures. Furthermore, the most comprehensive bill for the control of interstate commerce on the highways that has yet been drawn has just been introduced in Congress by Chairman Rayburn of the House Committee on Interstate Commerce, who proposes to press for its passage at this session of Congress.

These developments are of direct concern to railway

employees, indicating as they do that the public is awakening to the abuses of highway transport and to the inequalities under which the railways have been laboring. No small part of this progress is due to the education of the American public by railway employees who, individually and through their various organizations, have become a militant force in behalf of fair play in the transportation industry. But the battle is only well started. Every employee must carry on.

ORGANIZATION

New Problems Introduced as Forces Are Increased

OF ALL the developments that have taken place in the conduct of track maintenance during the last decade, there is one that suffered almost no set-back with the advent of the depression. In fact, the movement to effect changes in the track maintenance organization was expedited rather than retarded by the dire necessities of the period of diminishing expenditures.

That some of the innovations of the last four years are by no means depression measures, is demonstrated by the fact that they comprise deviations from, or extensions of, schemes of reorganization that had their inception prior to 1930. It is apparent, also, that many of the changes made during the depression followed as a consequence of the intensification of a condition that was becoming increasingly apparent during the twenties.

Because of the marked increase in the life of various elements of the track structure and because of the urge to conduct as many operations as possible with gangs large enough to develop the full advantage of the use of power tools, there had been a gradual decrease in the size of section gangs. This tendency was deliberately accentuated on one railway by the introduction of large maintenance gangs, restricting the section gangs to little more than policing, but even on those roads that did not go that far it was becoming increasingly difficult to obtain adequately productive work from the small section gangs. This condition, of course, was greatly intensified as the section forces were reduced during the depression—in many cases, to a foreman and one man. The result has been fewer and longer sections, with the introduction on at least two roads of the inspector-supervisor to take over part of the duties of both the foreman and the roadmaster. Also, on certain branch lines of some roads, one or more floating gangs have replaced all of the section gangs.

What will be the effect, on these new types of organization, of the increase in the track maintenance forces that will take place as the expanded programs for the coming season are undertaken? One answer to this question is to be found in the statements of system maintenance officers who have contended that the changes in organization that they have put into effect are not mere temporary expedients, but that the set-up of the gangs now prevailing on both main and branch lines will be just as applicable in periods of heavy work as in times of restricted activity.

Another factor to be considered has its origin in the drastic reduction in supervision that was made during the last four years. Roadmasters' and supervisors' territories on many roads are now longer than formerly, and while this lessened supervision may suffice during periods of limited expenditure, it may not be adequate for the efficient administration of heavy programs. This, of course, raises a question as to whether any increased administration should be provided by decreasing the size of territories, by the adoption of the inspector-supervisor plan, or by some other expedient.

The track maintenance organization that is coming out of the depression differs materially from that which went into it. There is every reason to believe that even greater changes than those that have been made during the past few years will take place in the near future.

IMAGINATION

Must be Further Stimulated and Developed

THE entire transportation picture is changing. New problems are confronting the railways on many fronts. One of the most important of these is now and will continue to be the readjustment of railway service to the changing and more exacting demands upon transportation. Speed and convenience are two of these demands which are being made with increasing emphasis. Railway men of all ranks and of all departments of service must reorient their thinking to meet these demands, and this by no means excludes men in the engineering and maintenance of way departments. If lighter equipment and higher speeds are to obtain, safe operation will depend largely upon these men.

It was once said by an eminent business man that "adaptability" was the principal requisite to practical success. Recently, a chief maintenance officer on one of the larger roads of the country, commenting on the above statement, said that he preferred "imagination" —that quality of imagination that looks beyond the present, no matter how satisfactory the present may seem, that constantly visualizes better methods and means of doing work and constantly anticipates the needs of the future. Never in the history of the railways was this sort of imagination needed more than now. It goes without saying that all general and supervisory officers must attain this quality to a high degree, but that is not enough. It must be fostered and stimulated by these men all through their organizations.

Fixed rules and standard practices must be set up for the guidance and safety of any large body of men working under the conditions presented on the railways, but they should not be so watertight and inviolate as to stifle all initiative and imagination. The maintenance of way officer referred to above is a living example of the theory he holds. He abounds in imagination and has permeated his entire organization with the same spirit. All new men brought into the organization are admonished personally to be creative, and the older men are never free from this influence.

That this has produced marked results on the railroad concerned is evidenced on every hand; in the track

structure, in work organizations, and in the methods and equipment employed. Many of the latest methods and units of work equipment are utilized to a large degree, tests and experiments are constantly under way, and, furthermore, nothing is accepted as the final attainment.

The degree of adaptability or imagination which will prevail among railway men during the next 10 years will largely determine the extent to which the railways of the country will progress. Indications point to the fact that the railways will meet the challenge of the times and will not permit themselves to be out-moded or out-classed. Whatever may come, however, let it not be said that engineering and maintenance of way men have not contributed their full share because of any lack of sufficient sound imagination.

FLANGEWAYS

Highway Crossings Impose a Serious Responsibility

EVERY man having to do with track work is aware of the extent to which the highway grade crossing has assumed increasing importance during the last 10 or 15 years. As every one knows, this has come about by reason of the development that has taken place in the volume, weight and speed of highway traffic. In the main, therefore, attention has been centered on the improvement of the crossings to provide the requisite strength and wearing qualities to resist the burden imposed by the highway traffic and to provide a surface that will insure satisfactory riding qualities. But there is one detail of crossing construction that has been studied and improved in recent years, primarily in the interest of the safe handling of rail traffic, namely, the flangeway.

That the flangeway has always had an important bearing on safety is conceded. Serious train accidents resulted from the filling of flangeways long before the automobile or motor truck was a factor in highway traffic, but the advent of the new types of highway vehicles and the increased volume of highway traffic, together with the greater use of highway work equipment, have imposed a far greater burden on the flangeway than in the past.

The effect of hundreds of rubber-tired wheels passing over a crossing during a sleet storm, in the interval between trains, in filling up inadequate or poorly maintained flangeways is a matter too serious to be disregarded. To this also must be added the effect produced by highway snow plows, or, as in the case of a fatal accident that occurred last year in Georgia, that of a road scraper which, being dragged across the track, filled the flangeways and left a ridge of sand and dirt across the rails.

Fortunately, the improved designs of flangeways now available, if properly installed and adequately maintained, tend to minimize these hazards; in fact, they present practically no hazard even under severe conditions. There are, however, special situations in which the best construction will not insure safety without the exercise of vigilance on the part of the section gang. It has been found, for example, that a crossing near a quarry, that carries a heavy traffic of stone screenings must be policed carefully during a snow or sleet storm to keep the flangeways clear of the dangerous combination of sleet and stone particles. A similar situation is presented at a crossing located on the down hill side of a highway cut that is subjected to wash during heavy storms. Thus, in spite of the safety of well-constructed flangeways under normal conditions, there is always the possibility for the unusual or unforeseen, primarily the presentation of some unexpected condition on the highway that may be an immediate cause for trouble in the flangeways. To meet such situations there is no substitute for constant watchfulness.

SCOUR

How Can the Effect on Bridges Be Checked?

NO more important duty confronts maintenance of way forces than that of insuring the safety of train movements across bridges. Bridge engineering is one of the most exact of the applied sciences in all respects except in-so-far as it concerns foundations, but with respect to these the designer is circumscribed by rather definite limitations. For reasons of economy, he cannot provide a design that will insure the safety of every structure in the face of such extraordinary conditions as might be created as the result of a cloudburst.

For this reason, the bridge engineer must depend on the division maintenance forces, particularly the bridge foreman and in most cases the section foreman as well, to detect quickly any change in foundation conditions that may endanger the stability of the structure. However, because no two bridges or trestles are alike, and because it is impractical to place plans or foundation records in the hands of every foreman, it has not been easy to give the man on the ground the information that he needs to enable him to pass intelligent judgment on any condition that he observes. For this reason it is of interest to note the plan that has been followed for a number of years on the Chicago, Burlington & Quincy, which enables any employee to check up the situation at a bridge very quickly.

Since this plan was adopted, every bridge pier and abutment carries a horizontal mark near its top, over which is a Roman numeral indicating the distance in feet from this mark to the bottom of the footing, while if the footing is supported on piles, a second numeral just below the mark indicates the distance to the bottom of the piles. The piles of all wooden bents and the caps over all concrete piles are similarly marked. Thus, any man at the bridge site, if he is able to take soundings at all, can determine at once whether any scour that has occurred is endangering the structure.

This plan is so simple and at the same time so thoroughly effective that it should be given serious consideration on those roads that do not now provide an effective equivalent for it. Its cost is small compared with the expense that might be involved in the failure of a single structure.

Power Equipment Used in Taking Up Abandoned Line

BECAUSE of the greater frequency with which little used railway lines are now being abandoned, the operations involved in taking up the tracks and structures of such lines are assuming a larger significance. Not only do they impose the problem of determining the most economical organization and methods for the conduct of the salvaging work but also that of deciding what materials can and what materials cannot be picked up at a profit. This subject was the object of an intensive study by officers of the Louisville & Nashville late last year, after authority had been obtained from the Interstate Commerce Commission to abandon the 75 miles of line between Frankfort, Ky., and Irvine.

Line Was Built 42 Years Ago

That portion of this line between Versailles and Irvine, 60.8 miles, was opened for traffic in 1891 as the Louisville & Atlantic, which was acquired by the L. & N. in 1909, and when the portion between Versailles and Cliffside (Frankfort) was completed in 1911, it was expected that this line would serve as a link in the route between the Eastern Kentucky coal fields and Louisville. However, the completion of a low grade line from Irvine to Winchester eliminated this eventuality, and the Louisville and Atlantic was definitely relegated to minor branch-line service, which finally diminished to so small a volume as to lead to the plans for its abandonment.

In some respects, however, the physical characteristics of the line were measurably higher than those of the average light-traffic branch line. The main track rail was mostly of 80 and 90-lb. patterns, with a limited amount of 70-lb. section. The ties were nearly all treated and tie plated, and were bedded in stone, gravel or cinder ballast. The condition of the ties is indicated by the fact that an average of about 2,000 ties were salvaged per mile of main track. Sidings, from 800 to 2300 ft. long, were spaced at an average distance of four miles, and were laid mostly with 60-lb. rail. There was an average of about one bridge per mile of line, including 10 metal structures, ranging from a single 60-ft. deck girder span to a bridge across the Kentucky river that embraces one 300-ft. and three 150-ft. deck-truss spans, and 778-ft. of viaduct approach. This bridge and two high steel viaducts 570 ft. and 770 ft. long, respectively, were not salvaged. With the exception of these bridges and one frame trestle, the bridge openings on this line were crossed by creosoted pile trestles with ballasted decks. There were only two overhead bridges and three short tunnels. The grades ranged to a maximum of 1.73 per cent and the sharpest curvature was 9 deg.

At the Left—A Pneumatic Wrench was Used to Remove all Bolts but One in Each Joint, While Two Spike Pullers Withdrew the Spikes From the Ties To Be Taken Out in Advance. Below—A Gang was Employed to Thin Out the Ties.

Operations Carefully Planned

The speed and economy of a salvage operation such as this are predicated largely on the extent to which the final operation—that of removing the rails and any other material remaining—can be reduced to a minimum by preliminary operations that embrace the removal of as much material as possible without endangering the safety of the track for such use as must be made of it in the final operation. The high average condition of the ties pointed to the advantage and practicability of thinning them out—about two out of every three, except where the presence of poor ties did not permit the removal of that proportion. It was also found possible to reduce the ballast deck trestles to the equivalent of open-deck trestles in advance of their complete removal.

Careful consideration was given also to the selection of the equipment. Studies indicated that small rail-laying cranes could be handled much faster in the final operation of taking up the track. On the other hand their capacities were not sufficient for effective work in salvaging the piles and timbers of the trestles Consequently a locomotive crane was provided for this work, as it would have been needed in any event for the removal of the girder and truss spans. However, as the services of the locomotive crane were required in the final operation only when the end of the track was at a bridge, the working program was laid out in such a way that the large crane was employed mainly in the preliminary operation.

The first step embraced an inspection of the main and side tracks by the chief lumber inspector and his assistants, who marked with paint every tie to be salvaged. This work served as a valuable guide in plan-

Careful planning insured economy in the salvaging of the track and bridge material on L. & N. branch in Kentucky 75 miles long

ning and carrying out all the subsequent operations.

The first actual salvaging operation comprised the removal of all the bolts in each joint except one and the pulling of the spikes in the ties that were to be removed in advance. One spike was left in each tie plate on the ties to be removed so that the plates would remain attached to the ties when they were taken out. The equipment provided for this work included two Ingersoll-Rand pneumatic spike pullers and one pneumatic wrench, served by a self-propelled air compressor equipped with a cantilevered frame for the spring suspension of the spike pullers. With this outfit a gang consisting of six laborers and an assistant foreman was able to cover about 1½ miles of track a day.

In this gang, the foreman placed a keel mark on the rail to indicate the ties to be pulled, one man with a wrench "cracked" the nuts so that the pneumatic wrenches could turn them, two men operated the air wrenches, two more the spike pullers, and one man attended the compressor. The spike pullers removed the outside spike on one rail and the inside spike on the other rail of each tie to be pulled and also thinned out some other inside spikes. On stretches of the track where the bolts were rather old and rusted to the nuts, it was found necessary to burn off the nuts with an oxy-acetylene torch, which was employed also in connection with the bridge salvage work.

This outfit was followed by a gang of 12 to 14 men who jacked up the track, removed the ties that had been marked to be pulled and piled them up along side the track. Where practicable, the ties were piled so as to span the ditch for convenience in applying the sling for loading them. The size of this gang was adjusted to enable it to keep ahead of the other operations, men being transferred from this gang to the bridge gang or vice versa as conditions demanded.

Typical Organization

A typical organization for this gang embraced two jackmen—using four jacks—moving up and setting one pair of jacks while the other pair was holding up the track, four men pulling ties, four men ricking ties and one man pulling the spikes that had not been withdrawn by the pneumatic outfit.

The piles of ties were loaded by the locomotive crane at such times as it could be released temporarily from the bridge work. This work was done by a gang consisting of three laborers and an assistant foreman, with two of the men on the ground and the other two in the car. This outfit and crew loaded two cars in 1½ to 2 hours.

The decks of the ballast deck trestles on this line

Two Views of the Outfit and Gang Employed in Taking Up the Track. Rails were Loaded in the First Car and the Bundles of Ties were Transferred from the First Crane to the Second One To Be Loaded in the Rear Car.

consisted of 12 stringers, 5½ in. by 16 in., covered with a floor of 3-in. by 8-in. planks, with a guard or curb timber along each side to retain the ballast. The advance salvage work on these trestles was carried out as follows: The curb timbers and some of the ties were removed and thrown over the sides, thus facilitating the disposal of the ballast in the same manner until enough had been removed to permit some of the planks to be taken out so that the remainder of the ballast could be shoveled out between the stringers. During this operation the track was supported on jacks until the ties could be blocked up on some of the planks previously removed. Then, after all the ballast had been cleaned out and all the planks had been removed except those under the ties, the track was again jacked up and the blocking removed so that the ties could be brought to bearing directly on the stringers.

This operation was carried on progressively along the bridge to insure that a suitable ramp could be provided at any time for the passage of the locomotive crane or a work train. It also involved the digging out of the ballast on each approach to provide run-offs to the lowered track level across the structure.

All of the planking, which was thrown over the side, was piled up and loaded out by the locomotive crane, which also removed two outside lines of stringers along each side of the bridge. The gang employed on this bridge work included one first-class bridge carpenter, three bridge laborers, an oxy-acetylene torch man and a helper burning off nuts or bolt heads, and as many common laborers as were found necessary to keep up with the preliminary track work. This of course depended to a large extent on the amount of bridge work per mile.

All of the preliminary work was carried on at a rate such that the loaded cars of released material could readily be set in the third siding from the end of track. This was done to keep the last two sidings clear for

the final salvage operations. In a few cases, where the sidings were spaced considerably more than four miles apart, temporary sidings were constructed.

The final operation of picking up the track was handled with the aid of two full-revolving rail-laying cranes, but the locomotive crane was taken off the preliminary work whenever the end of the track reached a bridge so that it could be employed to salvage the bridge material.

The cranes were employed in tandem formation, each with a gondola car coupled behind it. The force employed consisted of 23 men and a foreman. Several

Removing the Blocking Under the Ties After the Ballast and Planking Had Been Removed so that the Track Could be Lowered on to the Stringers Prior to Being Taken Up

men were assigned to work behind the cranes, pulling all the remaining inside spikes and loosening the nuts on the remaining bolt in each joint, but the greater part of the force was employed in the actual picking up of the material—as tong men to pull the rail clear of the splice as it was being lifted by the crane, and to pick up and pile the ties for handling by the crane. The ties removed from each half rail length were piled over the rail next to be taken up, so that the ½-in. wire cable sling, which had been laid down next to the rail, could be quickly looped over the hook on the load line of the crane.

Loading the Rail and Ties

The crane, as it picked up a rail or a bundle of ties, swung the load around and set it down in the gondola car behind it, moving back a half rail length at the same time. If it was a rail, it was released in the car, but if it was a sling of ties, the load was transferred to the load line of the second crane, which then swung it around and dropped it into the rear gondola car. As the joint bars were picked up with the rails and the tie plates stayed on the ties, it required the services of only one man to pick up the spikes and bolts. All ties not fit for salvage were left in the track, most of them being removed by farmers along the line. These ties were, of course, those that had been in the track the longest and were therefore equipped with tie plates of obsolete patterns, mostly "Goldie" plates of small dimensions, and it required little study to indicate that their scrap value would not pay the cost of picking them up.

The rail cranes handled the gondola cars with their own power while taking up track, but because of the greater speed possible the cars were moved between the end of track and the nearest siding with their loads by the locomotive in work train service on the job. The number of moves necessary during the day depended on the progress made, which averaged about 1¼ miles of track, approximately three cars of ties and three cars of rails being loaded per mile of track taken up. During the intervening times, the work train crew was employed in moving loads to sidings farther back on the line and bringing empty cars forward. About once a week another work train crew delivered a supply of empty cars and hauled out the loaded cars from 50 to 60 cars per week.

Salvaging the Pile Trestles

One of the most interesting features of the salvaging project was the removal of the pile trestles, which had previously been reduced to skeleton form, as described in a preceding column. The usable stringers and caps, and all good piles over 18 ft. long above the ground line were salvaged. The rails, remaining ties and most of the stringers were removed in the same manner as in taking up the track on the roadbed, all the stringers being removed in the two end panels. To salvage the piles, they were sawed nearly through at the ground line, after which a line attached to the farthest bent was used to pull down all the bents at once. The locomotive crane was then used to load the timbers and piles.

The salvaging of the material from this line was completed in 94 working days and involved the loading of 555 carloads of ties, 210 carloads of rail, 137 carloads of bridge timbers, 17 carloads of bridge steel, 2 carloads of office equipment, one carload of signal ap-

Two Stages in the Salvaging of a Trestle—Above, Removing the Track—Below, Pulling Over the Bents

paratus and 3 carloads of material salvaged from a water tank, or a total of 925 cars. Concrete mile posts, and all clay, corrugated iron and cast iron culvert pipe that could be removed with a limited amount of excavation, were loaded out with the rail.

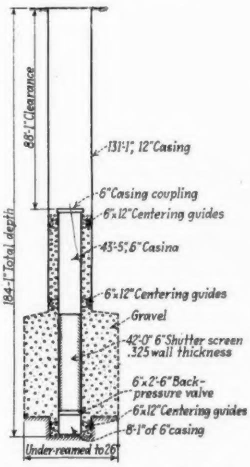
The plan for taking up the Louisville & Atlantic line of the Louisville & Nashville was developed by J. R. Watt, engineer maintenance of way, who exercised general supervision over the salvaging operations. The work was under the immediate direction of J. B. Cochran, assistant engineer.

Gravel Wall Wells Reduce Cost

Automatic electric installations replacing steam plant pumping from river also improve quality and increase reliability

By C. R. KNOWLES
Superintendent, Water Service, Illinois Central

THE Illinois Central has reduced the cost of providing and materially improved the quality of the water furnished locomotives at Grenada, Miss., through the development of a water supply from deep wells. The new system consists of two wells 184 ft. deep and operated by electric driven turbine pumps, replacing a steam plant pumping from a river.



A Section Through One of the Wells

Grenada is a junction point on the Chicago-New Orleans main line, 618 miles south of Chicago. At this point branch lines diverge to Fulton, Ky., via Jackson, Tenn., and to Greenwood where connection is made with a line of the Yazoo & Mississippi Valley, a part of the Illinois Central System. The consumption of water at Grenada ranges from about 3,000,000 gal, per month at the present time to a demand under normal conditions of about 6,500,000 gal.

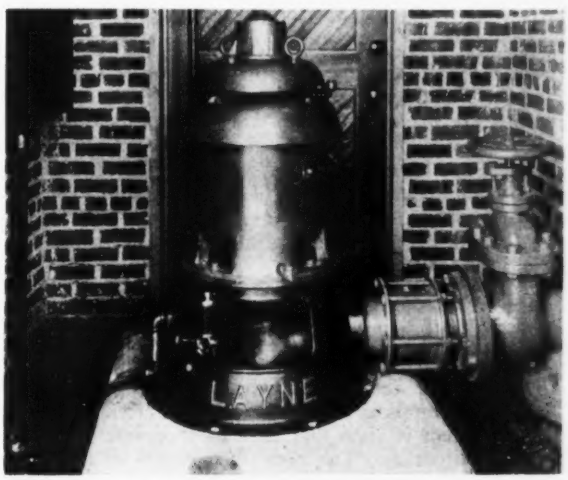
The old steam pumping station, which was built many years ago, had about outlived its usefulness and the expense of maintenance was excessive. Also, it was becoming increasingly difficult to maintain an intake on account of frequent channel changes in the stream from which the water supply was obtained. The pumping station was located at the junction of the Bogue and Yalabusha rivers. Flood stages brought down enormous quantities of mud and sand, forming bars and repeatedly changing the position of the channel. The material carried by the rivers frequently covered the intakes to a depth of several feet. While more or less difficulty had always been experienced with intake lines at this point it became more frequent and troublesome in recent years.

Locate Water-Bearing Sands

As the necessity for the renewal of the old station became apparent, an investigation was made to ascertain the possibility of developing a more satisfactory and dependable supply from wells. Test borings at the proposed site of the wells showed that an ample supply of water of a good quality could be obtained from water-bearing sands known as the Holly Springs formation. The static level of the water is about eight feet below the surface. In order to secure the desired amount of water without excessive draw-down or lowering of the water level in the well, what is known as the gravel-wall type of well was constructed.

The static water level in a well when it is not being pumped is the same, regardless of the type or size of well. The flow of water into a well is the result of the head developed by the difference between the level of the water in the surrounding water-bearing strata and the water level in the well itself. For example, the pumping level in a well drops below the static level to the point where the outside head or pressure is sufficient to force the required quantity of water into the well. Therefore, in order to maintain a minimum draw-down or pumping level, it is necessary to cut down the resistance through the sand and screen by increasing the area through which the water enters the well. As the cost of constructing large wells at Grenada was prohibitive, a gravel-wall type of well with large screen openings was adopted, thereby about trebling the area of the surface through which the water enters the well without a material increase in cost. As a result, these wells are now producing approximately 50 gal. per minute per foot of draw-down, as compared to an estimated production of 15 to 18 gal. per minute per foot of draw-down with a well of the ordinary type.

The wells are 184 ft. deep. They were constructed



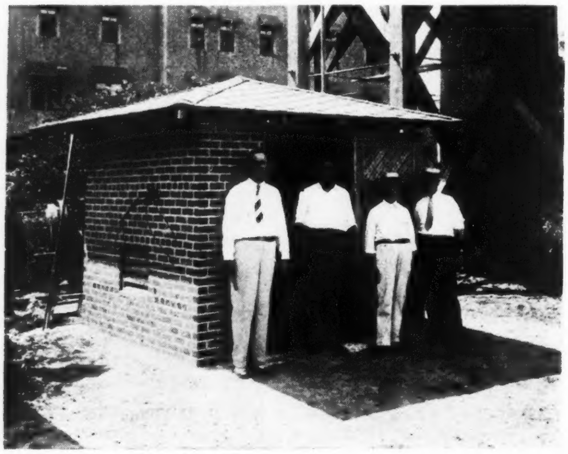
One of the Pumps Now in Use at Grenada

by drilling a 12-in. hole for the full depth with the 12-in. casing set to a depth of 131 ft. and under-reaming the hole below the casing to a diameter of 26 in. down to within 8 ft. of the bottom. The screen consists of 42 ft. of 6-in. shutter screen, with 8 ft. of 6-in. blank casing coupled to the bottom and 43 ft. 5 in. of 6-in. casing to the top, bringing the top of the 6-in. casing up inside the 12-in. casing of the well to a point 88 ft. below the surface. A back-pressure valve was placed in the 6-in. casing at the bottom of the screen to prevent sand or mud from entering the well. The 6-in. casing is centered in the well by guides at the bottom, just above the top of the screen and near the top of the 6-in. casing. After the screen was placed in the well the space around it was filled with carefully selected and screened gravel, which was inserted at the surface between the 12-in.

outer casing and the 6-in. inner casing.

Temporary pumping equipment was installed and the fine sand particles surrounding the gravel were pumped out as the gravel was applied between the two casings. The process was continued until the desired area of gravel was secured. The substitution of gravel for the sand next to the screen not only increased the area of water entrance but also made the use of larger screen openings possible.

The pumps are 12-in. 4-stage vertical, centrifugal pumps with impellers 7⅜ in. in diameter operating at 1,170 r.p.m. With a delivery of 320 g.p.m. at a total head of 55 ft. the efficiency of the pump is 75 per cent and the overall efficiency of the plant is 66 per cent. The pumps are driven by 10-hp. vertical motors direct-connected to the pump by 1½ in. line shafts. The pump settings are 22 ft. below the surface. The suction pipe is 6 in. and extends 20 ft. below the pump. The discharge or eduction pipe is 7 in., discharging into an 8-in. cast iron discharge line at the surface of the ground.



The Roofs of the Pump Houses May be Removed When It Becomes Necessary to "Pull" the Wells

Automatic Operation

The pumps are automatically operated, with the control so adjusted that in the event one of the pumps fails to operate the second pump will start after a brief interval. The pumps require practically no attention, as the oiling system is such that they may operate for weeks without attention. The pump houses are of brick construction, 7 ft. square inside with a 7-ft. 6-in. ceiling. The roofs of the pump houses may be removed when it becomes necessary to "pull" the wells.

The water formerly secured from the river was of a fair quality but at times, as stated above, it carried large quantities of mud and sand which made it objectionable for use in boilers and also interfered with the operation of the pumps. The water from the new wells is practically free from incrusting solids and is clear and free from mud and sand at all times. The comparative analysis of the two waters is given in the accompanying table.

The new wells have now been in service for 14 months, and the operating costs have shown a marked reduction as compared with the cost of operating the old plant. During this 14-month period 43,477,158 gal. of water has been pumped, at a cost of $2,096.67, including interest on investment, maintenance, depreciation (based on an estimated life of 20 years), cost of current, lubricants and attendance. This represents an average cost of less than 5 cents per 1,000 gal., as compared to a cost of about 10 cents per 1,000 gal. for the old station. In addition, the new plant is more reliable in operation. There is also a further saving in the cost of maintaining locomotives, by reason of the fact that the water furnished from the wells is of better quality than that pumped from the river.

The economy in operation of this plant is due in no small measure to the extremely low power cost, which is in turn due to the type of well construction, which results in a minimum draw-down and consequently a low pumping head. The current consumption, based on a 25-day test immediately following the completion of the wells, averaged 0.4 kw.h. per 1,000 gal. of water pumped.

Comparative Analysis of Waters

	River	Wells
	Grains per gallon	
Iron alumina and silica oxides	0.56	0.02
Calcium carbonate	0.41	1.05
Calcium sulphate	0.55	.....
Magnesium carbonate	0.54	0.78
Magnesium chloride	0.28	.....
Alkali chloride	0.26	2.42
Alkali sulphate	0.00	0.28
Alkali carbonate	0.00	9.40
Suspended matter (average)	6.00	0.00
Total incrusting solids	2.34	1.85
Total non-incrusting solids	0.26	12.10

Dismantles Overhead Bridge by Unique Method

By PULLING an abandoned overhead interurban bridge down onto its tracks by means of a cable attached to a locomotive and then dismantling the structure with oxy-acetylene cutting torches, the Michigan Central recently effected the removal of a hazardous structure at small expense and with a minimum of interference to trains. The bridge in question was located about five miles east of Jackson, Mich., where it formerly carried the tracks of an interurban line, the Detroit United Railway, over the double-track line of the Michigan Central. This line was abandoned in November, 1929, and the bridge, which was permitted to remain in position, became a hazard to the safe operation of trains on the Michigan Central because of the weakening of the substructure.

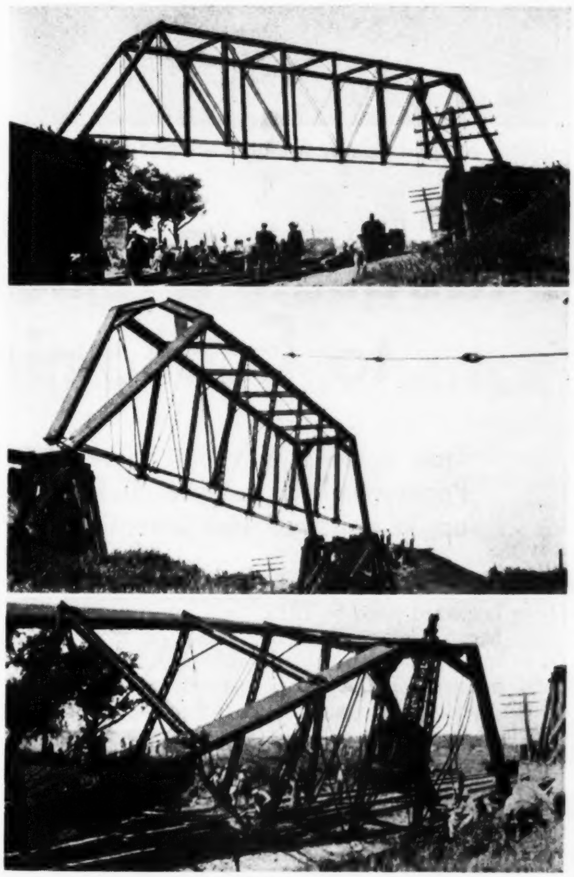
A Wrought Iron Through Pratt Truss

The interurban bridge crossed the railroad at an angle of 41 deg. and was constructed with a clearance of approximately 21 ft. above the top of rail. The superstructure consisted of a wrought iron through pin-connected Pratt truss span, 120 ft, long, which was supported on piers of timber piling which had decayed to such an extent that the timber was crushing under the load imposed by the trusses. These decayed piles also presented a fire menace.

Because of its limited load-carrying capacity, the truss span was of value only as scrap, and in view of this it was decided that the structure could be dismantled most economically by cutting it up by means of oxy-acetylene torches. In considering plans for dismantling the bridge, tentative studies were made of the falsework that would

be required to support the span while it was being cut into pieces for removal by a locomotive crane. However, the angle of the crossing was such as to call for such long spans between bents as to require the use of heavy I-beams for stringers, and the total estimated cost of the work, including the falsework, was about $3,500. This plan also called for considerable work-train service.

The plan finally adopted for removing the bridge was to pull the trusses down onto the track with a locomotive by means of a two-inch cable attached to one of the top cords. After being pulled down, the bridge was dismantled with cutting torches and removed with a locomotive crane. The actual cost of removing the bridge by this method was $700, or one-fifth the cost of doing the work on falsework. The time allowed by the operating department for the dismantling of the bridge was from 10 a.m. to 1:14 p.m., or 3 hr. 14 min. Actually, however, the tracks were cleared by 12:15 p.m. or about 1 hr. ahead of scheduled time.



Top—View Showing the Bridge After Preparations Had Been Made for Pulling It Down. The Floor Beams and Stringers Have Been Removed and a Notch Has Been Cut in the End Portal.
Center—The Bridge in the Act of Falling. Note How the Notch in the End Portal and the Absence of Floor Members Contributed to the Failure of the Structure.
Bottom—View of the Bridge Soon After the Cutters Had Commenced to Dismantle It.

The weight of the structure was about 60 tons. Timbers placed over and around the rails protected them from damage, and the impact did not throw the tracks out of line or surface. Signal and telegraph wires were protected by placing them in temporary cables and locating them out of range of the falling bridge.

In order to insure that the bridge would fall in such a position as to afford maximum convenience in dismantling it, certain preliminary steps were taken. Safety and speed in cutting the members of the bridge demanded that the heavy members be made to fall in as nearly the same plane as possible. This was true because otherwise it would be necessary for the cutters to use ladders to reach some of the members, which is an unsafe practice unless temporary shoring is used to brace the members, and it was desired to avoid the necessity for this because of the time required.

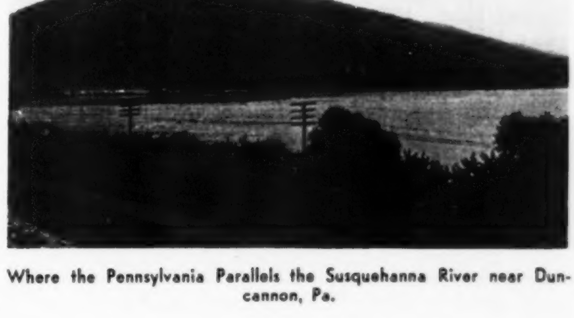
Accordingly, prior to pulling the bridge down, the entire floor system, one line of lower chord bars and the diagonal members of the top laterals were removed, and a V-shaped notch was cut in one of the portals in order to insure its failure as the bridge fell. These preparations were made to insure that the bottoms of the end posts at the weakened portal, together with the lower chords, would land on the ground in the same plane. As the notch was cut in the portal on the day before the bridge was pulled down, temporary cable cross-bracing was placed in the plane of the end posts to prevent the premature failure of the portal, the bracing being removed just prior to the wrecking of the bridge. The pulling cable was attached to a top chord near the weakened portal.

On the day that the bridge was pulled down, the following sequence of operations took place:

10:00 a. m.—Freight train BA-2 passed eastbound.
10:08 a. m.—Work engine arrived on eastbound track with a locomotive crane.
10:09 a. m.—The placing of timbers on the tracks to protect the rails was completed, and the cable was fastened to the locomotive.
10:16 a. m.—The pull was applied by the locomotive, the bridge being pulled out of its position almost immediately after the slack was taken out of the cable. The bridge was down on the track in less than a minute after the locomotive began to take up the slack in the cable.
10:21 a. m.—The cutting of wreckage was begun.
12:12 p. m.—The westbound track was clear of the wreckage.
12:15 p. m.—The eastbound track was clear of the wreckage.

Additional time could have been saved if the entire top lateral system of the bridge had been removed before pulling the trusses down. This was not done, however, because it would have been necessary to leave the bridge in the weakened condition for several days prior to its removal, during which period it would have presented a hazard to the operation of trains. As it was, the top laterals prevented the top chords from landing in a position convenient for cutting and it was necessary to support these members with timbers while the top struts were being cut.

On the day prior to the wrecking of the bridge, the foreman and the men who were to have a part in the work were thoroughly schooled in the procedure to be followed, so that each man was entirely familiar with the duties that he was to perform.



Where the Pennsylvania Parallels the Susquehanna River near Duncannon, Pa.

Cut Widening and Ditching Near Loudonville, Ohio, Which is Typical of Similar Work Done on Many Miles of the Central Region

A Typical Roadway Side Ditch in a Shallow Cut

Adequate Drainage to Economical

True value stands out on the Pennsylvania as roadway holds up in spite of less attention

LOOKING back over the last four years, the Pennsylvania railroad has reason to view with satisfaction the results of the comprehensive program of roadbed drainage which it carried out from 1926 to 1929, inclusive, a program which was initiated by a system operating executive whose early training and vision led him to comprehend thoroughly the importance of drainage in the economical maintenance of good track conditions. In these years, the Central region of the road made a concerted attack on water within and about the roadbed. Miles of tracks were raised and rebuilt on new cinder sub-ballast; miles of cuts were widened and re-sloped; miles of ditches were enlarged, re-shaped and re-pitched; several thousand feet of pipe sub-drains and culverts were installed; and several hundred miles of stone ballast was completely renovated by mechanical cleaning methods.

Maintenance Costs Reduced

In view of the experience of the last four years, there is only regret that more of this work could not have been crowded into the years immediately ahead of 1930, for the money spent then has resulted in a drier roadbed, absence of pumping track, less destruction of track materials, fewer man-hours of track maintenance, an absence of slow orders or speed restrictions—in all, a much better track, with a marked reduction in maintenance costs.

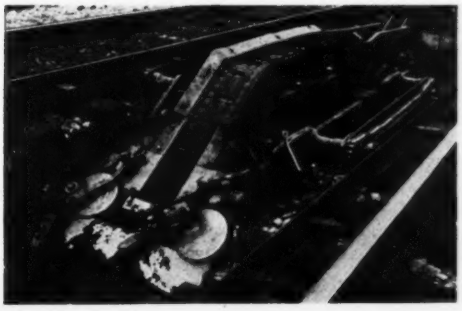
With much of the heavier drainage work out of the way by the latter part of 1929, and with increasingly limited funds, little of this work has been carried out since, but, on the contrary, routine ditch maintenance and ballast cleaning have been continued on a progressive scale, assuming a proportionately larger part of the total maintenance of way budget than at any time in the past. This is evidenced, in part, in the fact that whereas 340 miles of inter-track ballast were cleaned in 1928, and 454 miles in 1929, years of relatively high total maintenance of way expenditures, 394, 214, 491 and 580 miles of inter-track and shoulder ballast were cleaned in 1930, 1931, 1932 and 1933, respectively, years of materially reduced total maintenance expenditures.

In spite of the fact that drainage had by no means been neglected prior to 1926, the Central region in that year began a more aggressive attack on those cut and drainage problems which seriously aggravated the general problem of track maintenance. At many points earth cuts were so narrow as to cramp side drainage ditches; many side slopes were either too steep or not protected adequately by berm ditches, which permitted material to wash into the side ditches; many miles of side ditches themselves required widening and deepening; many new or enlarged culverts were required to carry the water from ditches or lateral streams; and, of a most serious nature, a number of miles of track, especially on the Panhandle division, between Pittsburgh, Pa., and Columbus, Ohio, required a major raising operation to pull it up out of low, wet, unwashed gravel ballast.

The latter work constituted one of the major items undertaken to improve drainage. On the Panhandle division alone, a continuous stretch of 53½ miles of double-track main line, between Dennison, Ohio, and Newark, Pa., was raised. Here, in a relatively flat and low country, that was difficult to drain suitably with side ditches, the gravel ballast, for the most part, was well worn and consistently wet. The pounding action of traffic had actually caused what might be termed "puddle columns" under the ends of the ties, while the looser material through the center of the track held considerable water as a water pocket. This situation was aggravated by the fact that the track shoulders had become fouled and tightly compacted over the years and effectively restrained drainage from the roadbed.

In remedying this situation, the addition of new ballast and resurfacing had proved expensive and only temporarily effective. In effect, it seemed only to increase the height of the puddle columns and the depth of the water pockets. What was needed appeared to be a ma-

One of the Two Types of Ballast Cleaning Equipment on Wheels That Have Been Used Effectively on the Pennsylvania



Hundreds of Miles of Ballast Have Been Cleaned on the Pennsylvania with "Moles"

e | Proves a Boon
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jor raising of the track, with the provision of an adequate depth of readily draining sub-ballast. In accordance with this need, the track was raised 2½ ft. out-of-face, first on 18 in. of cinders, and later, on an additional 12 in. of crushed rock.

In carrying out the work, all of which was done under traffic, the old ballast was first leveled off under the tracks and the tracks were then raised, generally, in successive lifts of six to eight inches, using Nordberg power track jacks and Jackson power track ballasters. The new sub-ballast was carried continuously across the roadbed and new shoulders were formed to meet the existing side slopes. After traffic had moved over the new sub-ballast for about nine months, during which time enough additional cinders were added to insure a compact bed at least 18 in. thick, the stone ballast was applied, being raised to grade stakes and generally in two lifts of 8 in. and 4 in., tamped with the power ballasters.

The work on the Panhandle division was carried out between 1927 and 1929, and, within this same period, about nine miles of double track on the Eastern division, in sections of various lengths, was treated in a similar manner. The result has been the same in all cases. The roadbed has largely dried out and become stabilized, pumping joints have been eliminated, line and surface are now easily maintained, and no more low spots remain where the high waters of lateral streams overflow the roadway periodically, fouling the track with dirt and debris. In all, the most troublesome stretches of track on the Central region, with their excessively high maintenance costs, were corrected prior to 1930.

Miles of Heavy Ditching Done

During the years in which these tracks were being raised to restore drainage, the Central region was also engaged in a program of major ditching and cut-widening work that was designed to keep as much water from the roadbed as possible, to promote the drainage of that water which unavoidably falls on the roadbed, and to stop the sloughing off and sliding of cut slopes into the side ditches. This work, which affected about 14 miles of line on the Eastern division, approximately 10 miles on the Panhandle division, and approximately 3½ miles on the Pittsburgh division, was all beyond the scope of routine ditch maintenance, and was, therefore, done under contract.

The extent of the work at different points varied in character and extent, but, in general, standard ditches were provided and, from their outside limits, the cut banks were sloped back on a plane corresponding with the angle of repose of the material encountered. To insure against wash, the new slopes were seeded promptly and then, in many cases, were covered with a three or four-inch layer of cinders, this having been found particularly effective in preventing the formation of wash seams and in giving the grass a good chance to get started. At some points where particularly unstable ground was encountered, honeysuckle plants were set out, in addition to the seeding.

Wherever the natural slope of the ground above cuts was toward the tracks, berm ditches of ample size were provided, at least 18 in. back from the top edge of the cuts. Normally, these ditches were made to drain to the ends of the cuts, but where this was impractical or where a large volume of water had to be taken care of, paved drains were provided to carry the water down the slopes to the side ditches.

Some of the cuts treated were relatively short and low, requiring comparatively little grading, while others were a mile or more in length, 40 to 45 ft. deep in places, and required as much as 25,000 to 40,000 cu. yd. of excavation. At many points the cutting back of the slopes required the purchase of additional right-of-way.

Little Work Train Service

One of the significant features of all of the heavy cut and ditching work is the fact that it was carried out with little or no work-train service, and without otherwise occupying any of the main tracks. For the most part, the contractors used crawler-mounted draglines and cranes and tractor-bulldozers, operated above the cuts, which either wasted the excavated material or loaded it into auto trucks for disposal. At a number of points, crawler-mounted steam shovels were used effectively without blocking the tracks and, in a few instances, where space permitted, narrow-gage cars were used. In several cases, sidings were abandoned temporarily to permit the use of the contractor's equipment, and, in a few cases, little-used sidings were taken up to make room for an adequate ditch without incurring the expense of widening the cuts and, in some cases, the purchase of additional right-of-way.

While the major cut work was being done under contract, the regular maintenance forces of the region, with 8 spreaders, 32 locomotive cranes, 21 ditchers and 30 gasoline engine-operated crawler-type cranes, cleaned, deepened, reshaped, or otherwise renovated several hundred miles of ditches on both main and branch lines. In addition, some sub-drainage pipe was installed beneath ditches and tracks, and culverts or cross drains of reinforced concrete and corrugated metal pipe were installed in making new openings or renewals as circumstances required.

The big effort in these years was to get the main lines in first class condition, although the branches were by no means neglected. In fact, mile after mile of spreader work was done on the branches, in addition to about four miles of heavy ditching in cuts and some track raising on cinders. In the spreader work the greatest care was exercised to avoid disturbing existing banks or slopes or removing sod unnecessarily, it having been learned that carelessness in this respect leads to rapid refouling of the ditches through sloughing off and slides, nullifying the cleaning and often causing considerable damage to the cut slopes. With much done, the major ditching operations were discontinued late in 1929, but in each succeeding year, including the present, a considerable part of the maintenance budget has still been spent for ditch maintenance work, employing principally the spreaders and the crawler-mounted cranes capable of operating both on flat cars and on the ground.

Special Drainage at Road Crossings

Other drainage considerations which have been given special attention in recent years include the problem arising at country highway crossings where the roadway slopes toward the tracks, and, with every sizable storm, brings large quantities of water, dirt, stones and other debris on to the roadbed. At many crossings this situation has not only made train operation hazardous through the filling of flangeways with dirt debris, and with ice in the winter, but it has invariably resulted in fouled ballast, a wet roadbed and bad riding track, almost regardless of additional attention which must necessarily be given to the tracks by the section forces.

The remedy for this situation is obviously to keep the highway storm water from the tracks and to divert it into the side ditches or cross drains as rapidly as possible. To this end, particular attention has been given to insure that the highway is kept well crowned so as to throw the water into its side ditches where it will follow prescribed drainage routes, rather than come down the center of the road and on to the tracks.

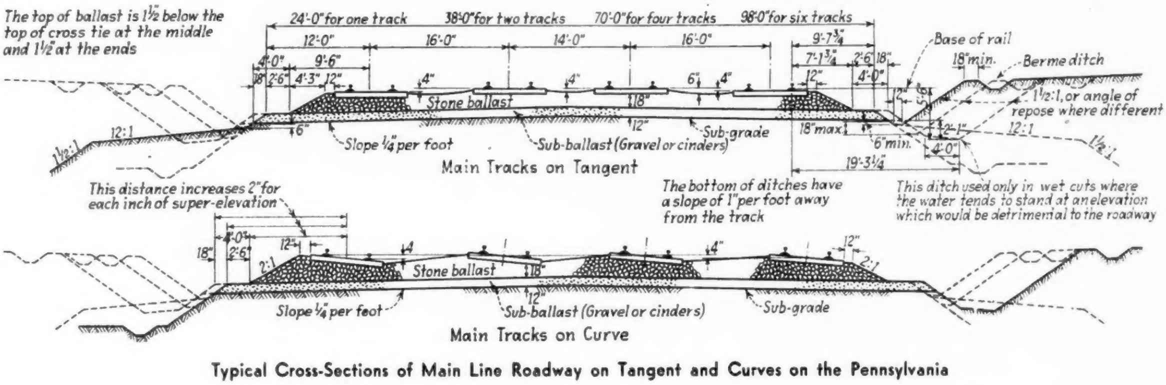
To assist in keeping the water from the tracks, especially where the highway cannot be kept sufficiently crowned, railway forces have been installing box drains across the road, with a grating of old rails, base up, over the top, so placed as to admit water readily and yet form a suitable surface for roadway vehicles. These box cross drains, which are made of concrete, are sometimes placed at a slight angle across the road to speed up discharge into the side ditch. The size of the box depends upon the amount of water to be cared for, which also determines the number of rails used in the cover.

The cover consists essentially of three or more rails, as required, which are set parallel to each other, base up, and then bolted together through holes drilled in their webs in such manner that while the webs remain parallel, they are tilted at an angle of about 30 deg. from the vertical. This throws the bases of the different rails out of surface, forming openings of a half inch or more between their adjacent edges, sufficient to admit large quantities of water. With the base openings facing up hill, the rail grating as a whole, extending the full width of the roadway, is placed in the box, its general surface being flush with the top face of the road.

In this position, the drain usually intercepts all or most of the water which may flow down the road. If it becomes fouled with dirt or stones such as can enter the openings between the rails, it can be cleaned readily by sweeping or by lifting out the rail grating.

Ballast Still Cleaned on Large Scale

While carrying on the various types of work described to effect better track drainage, the value of clean track ballast has not been overlooked. In fact ballast cleaning, using efficient mechanical equipment, has been one of the largest maintenance items in the Central region budget for the last six or more years. This is evidenced by the fact that from 1928 to 1933, inclusive, a total of 2,134 miles of inter-track and 339 miles of shoulder ballast were cleaned.



Typical Cross-Sections of Main Line Roadway on Tangent and Curves on the Pennsylvania

In 1928, working 18 "moles" and 12 locomotive cranes with screens, 340 miles of inter-track were cleaned. In 1929, with 30 "moles" and 8 cranes, 454 miles of inter-track were cleaned. In 1930, with 28 "moles," 354 miles of inter-track were cleaned, and, in addition, with two "border moles," the first time used, 40.2 miles of ballast border were cleaned. In 1931 the program was curtailed somewhat, but in that year, with 25 "moles" and 4 "border moles," 153 miles of inter-track and 61 miles of border were cleaned.

Indicative of the importance attached to ballast cleaning, even in years when the maintenance money that was available could have been spent profitably in so many ways, 491 miles of inter-track and shoulder ballast were cleaned in the region in 1932, while in 1933 the total was 580 miles. Of the 491 miles cleaned in 1932, 293 miles

of inter-track were cleaned with 23 "moles"; 94 miles of inter-track were cleaned with the Pennsylvania's large Brownhoist ballast cleaning equipment; and 104 miles of ballast shoulder were cleaned with 6 "border moles." In the program carried out during 1933, 319 miles of inter-track were cleaned with 22 "moles"; 127 miles of inter-track were cleaned with a Fairmont ballast cleaner, which was rented; 71 miles of ballast shoulder were cleaned with 6 "border moles"; and 63 miles of ballast shoulder were cleaned with the Fairmont cleaner.

The extent of the ballast cleaning work done in the Central region is the more significant when it is realized that there are only 988 lineal miles of main-line inter-track in the region. With the "moles" and the Fairmont ballast cleaner, the ballast is cleaned to a depth of 10 in. below the bottom of the ties, while with the Brownhoist unit, the cleaning extends to a depth of 18 in.

Work Proves of Great Value

What has all of this drainage improvement meant to the railway? While the benefits, both direct and indirect, cannot be expressed accurately in dollars and cents, slides have stopped, ditch maintenance has been reduced, the roadbed has largely dried up, joint conditions have improved, rail batter has been minimized, and the tracks have become more stable, both as regards alinement and surface. In effect, miles of roadway and track problems

Extensive Grading and Re-sloping Remedied the Drainage Problem in this Deep Cut

were solved and miles of roadway and track that were formerly a source of constant concern and excessive maintenance expense, entered the period of depression, restored on a permanent basis to the high standard of the tracks generally on the region.

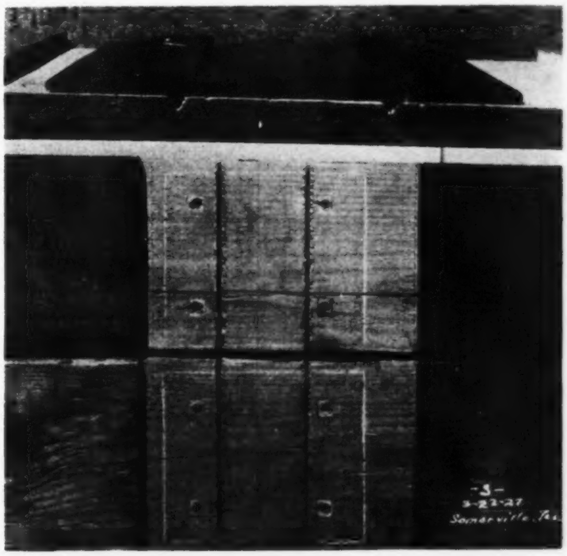
Track Standard Has Been Maintained

During the last four years, maintenance of way expenditures on the region have been largely reduced from what they were in the years prior to 1930, but, in spite of this, the standard of the tracks has been maintained. That this has been possible is due largely to the extensive drainage improvement work done prior to 1930, according to officers on the region, who continue in the belief that there are few classes of maintenance work which yield as large a return in the form of good track and reduced maintenance costs as properly planned and executed drainage work.

All of the work described or referred to in this article has been carried out under the direction of J. B. Baker, chief engineer maintenance of way of the Central region.

Grooves Ties to Receive Ribs of Tie Plates

THE Atchison, Topeka & Santa Fe, which uses tie plates with two longitudinal V-shaped ribs on the bottom, has adopted the practice of cutting grooves in the ties to accommodate the ribs of the tie plate. This is done to overcome the difficulties experienced with ribbed plates while relaying rail or in renewing ties before the tie plates become properly seated on the ties, and to obviate the crushing of the wood fibers by the ribs. The



Two Tie Plate Seats Grooved for the Ribs, and a Ribbed Tie Plate in Position on a Grooved Tie

grooves are cut in the ties in the same operation in which the ties are dapped and bored prior to treatment.

With ties prepared in this manner, the ribs of the tie plate fit naturally into the grooves, causing the tie plate immediately to assume its proper and final position on the tie without rupturing any of the wood fibers. In commenting on the advantages of grooving ties to receive the ribs of tie plates, W. H. Cleveland, retired general track inspector on the Santa Fe, made the following remarks:

"To groove ties before treatment prevents the mutilation of the wood fibers when the tie plates are becoming seated under traffic and also permits greater penetration of the preservative into the tie at the rail seat. It insures the location of the bored spike holes in the proper position in the tie and facilitates the attainment of standard gage.

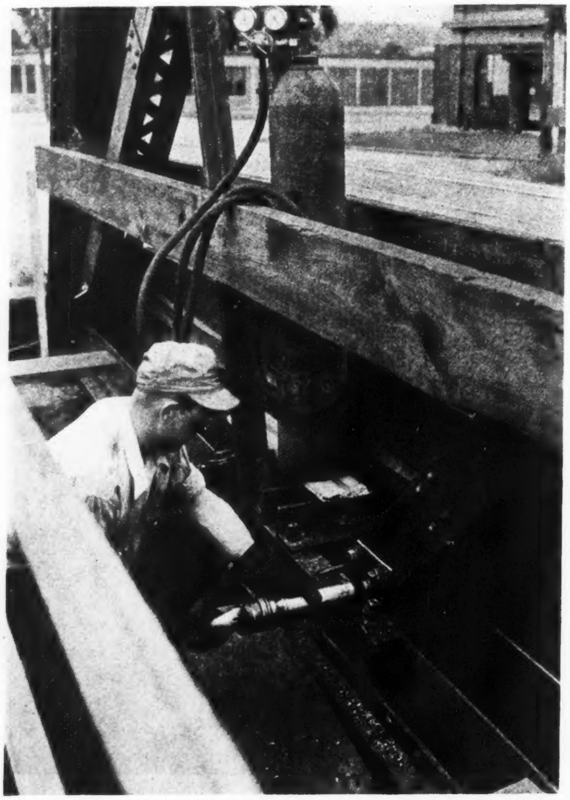
"By seating the plate flat and firm on the tie, with the ribs fully imbedded in the grooves, the rocking motion of the plate on the tie is eliminated. The tendency of ribbed plates to cant under traffic, resulting in the distortion of the gage, is likewise done away with.

"When renewing ties incident to resurfacing track, ribbed tie plates do not become fully seated at the time the work is being performed, and it is usually necessary to retamp such ties one or two times before the plates become fully seated. Obviously it is an expensive operation to remove the ballast and retamp the ties."

We are indebted to R. S. Belcher, manager of treating plants, Atchison, Topeka & Santa Fe System, Topeka, Kan., for the information presented above.

High Pressure Bottled Gas for Riveting

Delaware & Hudson effects considerable saving through use of cylinder nitrogen in place of compressed air for small bridge repair projects



About 25 Rivets Can Be Driven With One Cylinder of Gas (200 cu. ft.)—Note How Cylinder of Nitrogen is Placed Entirely in the Clear

WHILE the effectiveness and economy of using compressed air for driving rivets and, where necessary, for drilling holes when making sizable steel bridge repairs is generally recognized, the economy of this method is not nearly so marked in the small and scattered rivet renewal jobs with which every bridge maintenance gang is familiar. In fact, in these small jobs where compressed air is not readily available, which is usually the case, the cost per rivet is frequently out of all proportion to the amount of work done, due mainly to the time and expense involved in transporting and setting up a portable air compressor.

Overcome Disadvantage with Bottled Nitrogen

To overcome this disadvantage on small jobs, and at the same time retain the advantages inherent in driving rivets by power, the Delaware & Hudson is now using bottled nitrogen gas as the driving force, with the same rivet guns as are used with compressed air on the larger jobs. By this means the expense of setting up an air compressor is done away with, without in any way affecting the quality of the work itself or the speed with which the actual driving can be done. The gas used is furnished by the Air Reduction Sales Company in cylinders at 2,000 lb. pressure, there being enough gas in each cylinder to drive approximately 25 rivets. The particular advantages of this gas for use in pneumatic tools are that it is relatively inexpensive, and that it is inert, that is, it is neither combustible nor a supporter of combustion.

The use of nitrogen gas for small rivet jobs was first tried out on the Delaware & Hudson last year when a test was made at the Green Island bridge repair shop of the road at Colonie, N. Y., in fabricating a couple of floor beams for a turntable. In this work it was found that one cylinder of the gas (200 cu. ft.) would drive twenty-five ⅞-in. rivets in 12 min., at a total cost of $2.93, or an average cost per rivet of $0.117, of which $0.025 was for labor and $0.092 was for gas.

Placing these costs on the basis of 100 rivets, it was evident that with the usual gang of four men, 100 rivets could be driven in 48 min., at a total cost of $11.70. Using compressed air from a portable compressor, and with the same labor cost for the actual driving, it was estimated that the total cost of driving 100 rivets, assuming a reasonable charge for setting up the compressor, would have been $14.16, or $2.46 in excess of the gas method.

Larger Savings on Smaller Jobs

With the cost of handling the compressor practically fixed, regardless of the number of rivets driven, it was evident that the larger relative savings can be effected in the smaller riveting jobs, usually those requiring the placing of 100 or less rivets. On the other hand, where it might cost from $50 to $75 for moving and setting up a compressor, which is not at all unusual, the cost per rivet of driving with high-pressure nitrogen gas indicates that jobs requiring the placing of as many as 500 or more rivets can be done more economically by using the gas.

On the D. & H., the use of the gas has been confined largely to jobs of 50 rivets or less, in each of which cases a substantial saving has been made. For example, in a small repair job at the top of one of the towers of the road's lift bridge over the Hudson river at Troy, N. Y., 15 rivets were driven by gas pressure, using one-half cylinder of gas, with an estimated saving of $73, in addition to a saving of 6 hours in working time, over the cost of using a compressor. On another small repair job on a bridge just outside of Albany, requiring the replacing of 12 rivets, a similar saving was made, and on a larger repair job at Wilkes Barre, Pa., involving two bridges, a saving of about $100 was made over the cost of moving in and using an air compressor.

In the latter work, where 520 rivets had to be replaced, a large compressor, together with considerable piping, would have been required. All of this was avoided by

shipping 24 cylinders of nitrogen gas to the site of the work and setting them off where needed. The total cost of the repairs was approximately $55, whereas it is estimated that the use of compressed air would have raised the cost to approximately $155.

Gas Effective for Drilling Also

In several cases, the use of cylinder nitrogen has proved equally as effective, convenient and economical for drilling as for rivet driving. In the test conducted at the Green Island bridge shop, referred to previously, nine 15/16-in. holes were drilled through ½-in. steel with one cylinder of gas, at an average speed of approximately 30 sec. per hole. Later, in an actual repair job, twelve 15/16-in. holes were drilled through 3½ in. of metal in an equally effective manner.

The latter job was at a girder bridge at Elsmere, N. Y., where movement of the abutment masonry inward had caused all of the bolts connecting the bridge to the shoe

Drilling and Riveting Entirely With Cylinder Nitrogen in Making Minor Repairs to a D. & H. Bridge

castings at the fixed end to sheer off. Here, the use of air for drilling would have been inconvenient and quite costly, and drilling by hand would have been very difficult and equally as expensive. At the same time, the positions of the holes on the inner sides of the girders were not accessible for hand drilling. Using seven cylinders of nitrogen, the 12 holes that were required on this job were drilled in one day.

Supplying Gas Cylinders

The foregoing are examples of the effective use that is being made of cylinder nitrogen by the bridge repair forces of the D. & H., which keep a supply of the gas constantly on hand. In the various jobs undertaken, the cylinders required are shipped to the work on local freight trains and in the baggage cars of passenger trains, as conditions may require, or, if more convenient, are hauled to the work on a motor car trailer or a truck along with the bridge repair force. Because of the convenience of handling the cylinders, it is said that by using the gas, many of the small repair jobs can be completed within the time that it would ordinarily require to transport and set up a compressor.

The work on the D. & H. has been carried out under the direction of H. S. Clarke, engineer maintenance of way, and under the direct supervision of J. B. Clancy, supervisor of bridges.

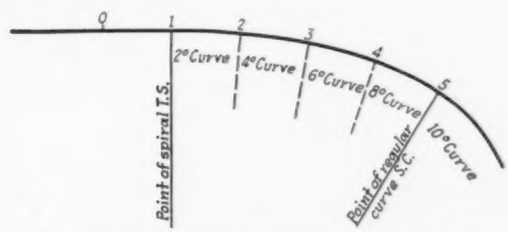
Simplifying Spiral Work in String Lining

By THOMAS WALKER

Roadmaster, Louisville & Nashville, Evansville, Ind.

WHEN adjusting curves by the string lining method, the calculation of the central portion of the curve is comparatively simple, but the application of spirals to the ends of the curve is somewhat more complicated and there appears to be some difference of opinion as to the proper spiral to use. With the idea of simplifying the work as much as possible, a basic spiral has been developed which may be made applicable to any curve merely by multiplying the middle ordinates of the basic spiral by the proper factor.

As the first step in developing the basic spiral, assume a ten-degree curve fitted with a spiral 124 ft. long, containing four 31-ft. stations, with the point of spiral (T. S.) at Station 1 and the point of the regular curve (S. C.) at Station 5, the curvature stepping up at the rate of two degrees for each 31-ft. chord, as shown in the accompanying sketch. The 31-ft. stations are used for con-



Sketch Illustrating the Development of the Basic Spiral

venience so that when a string is stretched over two stations, or 62-ft., the middle ordinate, if read in inches, will indicate the degree of curvature, according to the familiar rule. Theoretically, however, the stations should be 30.9 ft. long to indicate the degree of curve exactly.

The average curvature from Station 1 to Station 3 in the sketch is three deg., and it can be proved that with a string stretched from one to three, the middle ordinate at Station 2 is 3 in. Likewise, the middle ordinates at Stations 3, 4 and 5 would be 5, 7 and 9 in., respectively. With a string stretched from Station 0 to Station 2 (half on tangent and half on the spiral), the average curvature embraced would be 1 deg. and the middle ordinate at Station 1 would be 1 in. Similarly, with a string stretched from Station 4 to Station 6 (half on the spiral and half on the regular curve), the middle ordinate at Station 5 would be 9 in., but with a string stretched from Station 5 to Station 7, or entirely on the regular curve, the middle ordinate would be 10 in. The spiral, therefore, may be tabulated as follows:

Stations	Middle Ordinates
0	0
(T.S.) 1	1
2	3
3	5
4	7
(S.C.) 5	9
6	10
7	10
8	10

If the middle ordinates shown above were given in tenths of an inch instead of in full inches, exactly the same figures would apply to a 1-deg. curve in place of the 10-deg. curve, the spiral stepping up at the rate of 0.2 deg. per station. It should be noted that from Sta-

tion 0 to Station 1, and from Station 5 to Station 6, the stepping up, or rate of change of the middle ordinates, is only one half that between the other successive stations in the spiral. This basic spiral can be extended indefinitely and the regular curve can be made to begin at any station. As an example of the application of the basic spiral, assume that we wish to fit a four-degree curve with a spiral five stations long extending from Station 1 to Station 6, in which case the basic spiral would be as follows:

Stations	Middle Ordinates
0	....
T.S. 1	1
2	3
3	5
4	7
5	9
S.C. 6	11
7	12

Station 7 would be the first station on the regular curve and the basic middle ordinate for that station would be 12. For a four-degree curve, the middle ordinate would be 40 (measured in tenths of an inch with 31-ft. stations) and as 12 must be multiplied by $3\frac{1}{3}$ to make 40, all of the basic middle ordinates should be multiplied by $3\frac{1}{3}$, which would give the following spiral.

Station	Basic Spiral	Mid. Ordinates for Four-Degree Curves
0	0	0
T.S. 1	1	3
2	3	10
3	5	17
4	7	23
5	9	30
S.C. 6	11	37
7	12	40 (Factor $3\frac{1}{3}$)

If it is desired to make the spiral two stations longer, beginning the regular curve at Station 8 instead of Station 6, the spiral would be as follows:

Station	Basic Spiral	Mid. Ordinates for 4-deg. Curves (Fractions dropped)
0	0	0
T.S. 1	1	2
2	3	7
3	5	12
4	7	17
5	9	22
6	11	27
7	13	32
S.C. 8	15	37
9	16	40 (Factor 2.50)

Furthermore it might be assumed that the curve chord measurements indicated that the curve proper was not exactly four degrees but about 4.2 deg. As 16 is contained into 42, 2.62 times it would be necessary simply to multiply all the basic middle ordinates by 2.62 instead of 2.50 to determine the proper middle ordinates of the spiral.

The same procedure can be followed to secure any desired spiral. That is, determine the beginning and end of the spiral, also the middle ordinate to be used on the regular curve beyond the spiral, then tabulate the basic middle ordinates to the first station beyond the end of the spiral. Divide the basic middle ordinate for the first station on the regular curve into the middle ordinate to be used on the regular curve, then use this factor for multiplying all of the basic middle ordinates.

The basic spiral is simple and easy to remember and as the necessary factor is also easily secured, a spiral to fit any curve can be figured quickly, especially by using a slide rule, thus making the use of tables unnecessary.

The basic spiral can of course be used with any unit of measurement desired. That is, the middle ordinates can be figured in inches, tenths of an inch, hundredths of a foot, millimeters, or any other unit. Also the stations can be any convenient length, such as 31 ft., if it is desired to take advantage of the familiar rule of determining the degree of curvature, or 33 ft. or 39 ft. if the stations are to fall at rail joints, or 50 ft. so that the chords will be approximately 100 ft. if it is desired to use the numerous tables given in text books.

Spiral With 39-Ft. Stations

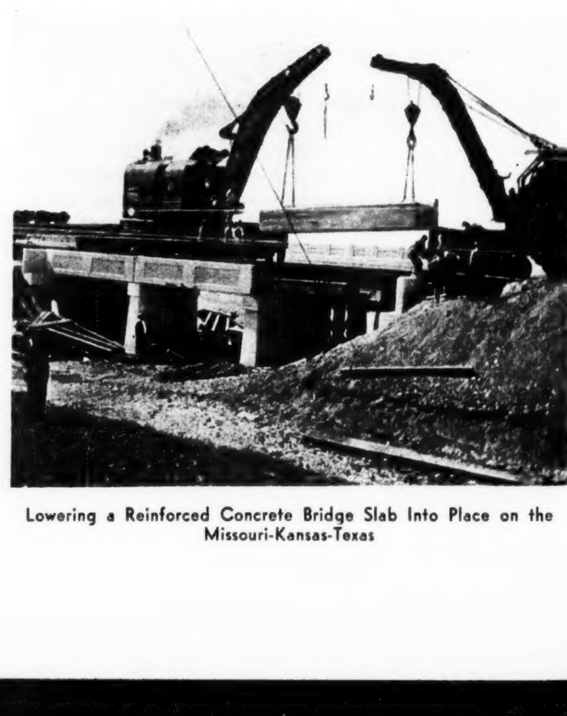
For example, assume that, instead of the spiral demonstrated above which consisted of five 31-ft. stations, it is desired to install a spiral having 39-ft. stations, with the middle ordinates measured in hundreths of a foot. Such a spiral would be four stations, or 156 ft., long. With 39-ft. stations and 78-ft. chords, the middle ordinate for a one-degree curve would be 0.133 ft. A four-degree curve would be four times this, or 0.532 ft., giving a factor of 5.3, as shown in the following tabulation.

Stations	Basic Middle Ordinates	Middle Ordinates for 4-Deg. Curve
0	0	0
T.S. 1	1	5
2	3	16
3	5	26
4	7	37
S.C. 5	9	48
6	10	53 (Factor 5.3)

A similar procedure would be followed in computing a spiral having five 33-ft. stations with the middle ordinates measured in hundreths of a foot. On a one-degree curve the middle ordinate of a 66-ft. chord is 0.095 ft. and for a four-degree curve the ordinate would be .38 ft., or 38 hundreths of a foot, giving a factor of 3.17 as shown in the following.

Stations	Basic Spiral	Middle Ordinates for 4-Deg. Curve
0	0	0
T.S. 1	1	3
2	3	9
3	5	16
4	7	22
5	9	28
S.C. 6	11	35
7	12	38 (Factor 3.17)

[Note:—The author has extended this method so as to provide a means for determining the middle ordinates of a spiral when the point of spiral and the point of regular curve do not coincide with track stations, but as this complication can nearly always be avoided, this elaboration of the general method has been omitted.—Editor.]



Lowering a Reinforced Concrete Bridge Slab Into Place on the Missouri-Kansas-Texas

Tie-Seasoning Yard at a Wood-Preserving Plant

Wood Preservers Discuss Railway Problems

Numerous papers and reports presented at convention deal with problems of maintenance officers

THE thirtieth annual meeting of the American Wood-Preservers' Association, which was held at Houston, Texas, on January 23-25, brought out much information that is of value to railway maintenance officers responsible for the selection and installation of timber in their tracks and structures—from ties to piling, poles and bridge timbers.

The meeting was presided over by R. S. Belcher, president of the association and manager treating plants, Santa Fe System. Frank D. Mattos, manager treating plants of the Southern Pacific, Pacific system, was promoted from second vice-president to first vice-president at the conclusion of the convention, while C. S. Burt, general tie and treatment inspector of the Illinois Central, was elected a member of the executive committee, to serve in that capacity with F. C. Shepherd, consulting engineer, Boston & Maine, and H. R. Duncan, superintendent timber preservation, Chicago, Burlington & Quincy.

The mutuality of interest between the railways and the timber treating industry was emphasized by Mr. Belcher in his opening address in which he pointed out that the railways consume 75 per cent of the output of the wood preserving plants. The railways, Mr. Belcher said, are the pioneers in timber treatment in this country. Through this practice, enormous savings have been effected in maintenance of way. Economies resulting from the extensive use of treated ties and timbers in years past have proved a godsend to the railroads during the past years of reduced earnings.

H. M. Lull Addresses Meeting

In welcoming the convention to Houston, H. M. Lull, executive vice-president of the Southern Pacific Lines in Texas and Louisiana, compared the policy of the federal government with reference to agriculture with that relative to transportation. On the one hand it is attempting to curtail production by offering bonuses for the curtailment of the cotton, wheat and stock output, while on the other hand it is contributing to the already great surplus of transportation by providing funds for more highways.

Mr. Lull then referred to the importance that timber treatment has long attained on the Southern Pacific. Aside from ties, 213 miles of main tracks of this road are supported on timber bridges. This road has in service a number of ballast deck trestles of creosoted material, that were constructed between 1889 and 1895 and that are still in good condition, with a majority of the original piling and stringers still in place. In the pile piers supporting a steel span over the San Jacinto river near Houston, there are a number of hewn octagonal creosoted long leaf piling 45 years old. The Southern Pacific built its treating plant in Houston in 1891. During the last 10 years 30,000,000 gal. of creosote has been used here.

Other Papers and Reports

A feature of the meeting that is of growing interest to railway maintenance officers was an address on termites, presented by Dr. Hermann von Schrenk, consulting timber engineer, St. Louis, Mo. In this address Dr. von Schrenk described the insects and their habits, their manner of attack on wood, the ways in which their presence can be detected and means to eradicate them and prevent their return. This paper will be abstracted in a later issue.

The Committee on Tie Service Records, of which W. R. Goodwin, engineer wood preservation, Soo Line, was chairman, presented its customary tabulation of cross tie renewals per mile of maintained track for 26 railroads, adding the figures for 1932. This record, which is now complete for these roads for the 22 years beginning with 1911, shows the progressive decline in renewals for each of these roads and also a composite record for the 26 roads (with 201,782 miles of tracks in 1932), the five-year average for all of these roads decreasing from 249 ties renewed per mile of track in 1911 to 142 in 1932.

The Committee on Marine Piling Service Records presented a report on an inspection of a dock in the St. Johns river at Jacksonville, Fla., built in 1909. In addition, it presented in tabular form, the necessary structural and treatment data and a brief inspection report concerning 16 other structures, all in San Francisco bay, of various ages up to 45 years.

Among other reports was one on the diversified uses of wood, which, in addition to referring to the use of treated wood in railway and highway bridges, mentioned a considerable number of new uses outside the railway field. A brief report was also submitted on the non-pressure treatment of poles.

The Committee on Preservatives, of which R. E. Waterman, chemist, Bell Telephone Laboratories, was chairman, recommended the withdrawal of specifications for creosote oil, grades 2 and 3, since there are now practically no creosotes of these two grades available except by special manufacture. The committee also recommended the withdrawal of Footnote No. 1 to the Standard Specifications for Creosote Coal-Tar Solution, which placed certain limitations on the use of this preservative, on the ground that the implication of the footnote no longer holds. These recommendations were approved.

Treating Green Ties

To determine the extent to which it is practicable to treat green beech, hard maple and yellow birch ties, the Forest Products Laboratories of Canada undertook a series of experiments with a 70-30 creosote-coal tar mixture. The results of these experiments were summarized by J. F. Harkom, chief of the division of wood preservation of the laboratory, as follows:

Penetration, equivalent to or better than that obtained in air-seasoned ties, can be secured in the treatment of beech, hard maple and yellow birch ties in the green condition, by either a preliminary oil bath or by the boiling-under-vacuum process.

Beech, hard maple and yellow birch ties differ considerab'y with respect to checking after treatment in the green condition, and observation of mixed, unidentified lots or charges is apt to be misleading.

Beech ties check severely after treatment in the green condition and should be air-seasoned before treatment.

It is doubtful if the treatment of green maple ties can be considered, owing to the fairly large percentage that check severely after treatment.

Indications are more favorable with respect to the treatment of yellow birch ties in the green condition, but comparison with air-seasoned ties in track is necessary before a definite statement can be made.

Seasoning Timber for Preservative Treatment

The evolution of the procedure for the air-seasoning of timber in the East Texas area was described by W. E. Jackson, superintendent of the Santa Fe Tie and Lumber Preserving Company at Somerville, Texas. After tracing the early studies that were made to determine the causes of early decay of timber, Mr. Jackson presented certain conclusions which are abstracted here.

It was early found that the ties in which decay appeared most quickly were of practically one month's production. The first ties found were of May production. In later years, June, July and August ties gave trouble. However, in any one year, only the ties produced in one of these months give trouble. Furthermore the intensity of the trouble varied widely. In some years there would be a loss of one half of one per cent of the ties in seasoning on account of decay; in other years with practically the same weather conditions the losses reach four or five per cent.

It was also found that there is a marked difference in the manner of seasoning of different classes of timber. Thus, piles, poles and round posts come into the seasoning yard without the wood structure being disturbed. As a result, fungus spores can find lodgment only in the ends. For this reason when such timber shows evidence of decay, it is possible to reclaim a large percentage by cutting the sticks back to shorter lengths. It has also been found that the steaming of this timber as soon as it is received at the seasoning yard eliminates possibility of decay since the infection with decay fungus occurs in the woods.

With ties, the problem is more difficult since the wood structure is cut into on all faces. Furthermore, the hewn tie is rolled around over the leaf mold and decaying vegetation in the woods, exposing it to infection. The seasoning in the yard is also different since the wood structure has been cut into. As a result all ties, except oak with anti-checking irons in the ends, have been trimmed to expose their ends, for the last 13 years.

Service Records of Petroleum Treated Ties

THE use and requirements of creosote and petroleum for use in mixture treatments was covered in a paper by J. S. Giddings, chemist, Santa Fe Tie and Lumber Preserving Co., Somerville, Tex. In this report attention was first called to the special mixture-treated ties in the Santa Fe test track at Cleveland, Tex. This test includes 815 hewn ties of several kinds of wood and treated with various mixtures, the proportions of which varied from one part creosote and two parts petroleum to one part creosote and four parts petroleum. These

Table No. 1.—Summary Mixture Treated Ties—Cleveland, Tex.

Proportion of Mixture	No. of Ties	Year Inserted	No. Removed to 12-31-32	Percent Removed to 12-31-32	Average Life in Track to 12-31-32
1 Creo. to 3 Beaumont	47	1912	27	57.45	15.62
1 Creo. to 2 Beaumont	38	1912	17	44.74	18.61
1 Creo. to 2 Beaumont	8	1912	0	0.00	20.00
1 Creo. to 2 Beaumont	87	1913	23	26.44	17.53
1 Creo. to 4 Beaumont	57	1912	25	43.86	18.63
1 Creo. to 4 Beaumont	87	1913	21	24.14	18.11
1 Creo. to 2 Oklahoma	38	1912	12	31.58	19.74
1 Creo. to 2 Oklahoma	87	1913	9	10.34	18.70
1 Creo. to 4 Oklahoma	37	1912	13	35.14	18.95
1 Creo. to 4 Oklahoma	87	1913	26	29.89	17.11
1 Creo. to 4 Oklahoma	214	1912	110	51.40	15.91
1 Creo. to 2 Ellinor	28	1912	19	67.86	17.11
	815		302	37.06	17.87

ties were treated in the experimental cylinder of the Somerville, Tex., plant of the Santa Fe in 1909 and 1910. All of these ties were inserted in the test track from 2 to 2½ years after they were treated.

The annual rainfall in the Cleveland area is more than 50 in., with high humidity and temperature practically throughout the year. The track is laid with 90-lb. rail, dirt ballast, 7½ in. by 9-in. tie plates, and cut spikes. While the figures on the average annual tonnage since the insertion of these ties are not available at this time, the 1929 gross tonnage was 4,187,684.

Table 1 is a summary of the ties, with the records grouped according to the kinds of mixture used, while Table 2 is a summary of the same ties grouped according to the kinds of wood treated. It will be noted that 302 ties, or 37.06 per cent, of the original 815 ties had been removed up to December 31, 1932. Thus, a total

of 513 ties remain in the track after a service of from 19 to 20 years under the conditions noted. The computed average life in track of the entire group up to December 31, 1932, is 17.87 years.

Attention was called, also, to a record of sawn western yellow pine ties inserted in track between Texico, Tex., and Lubbock in 1913. Out of a total of 8,259 ties inserted, only 239 ties have been removed after 19 years in the track. These ties were treated with a 50/50 creosote petroleum mixture, to 7 lb. per cu. ft. The average annual rainfall in this section is believed to be between 15 and 20 in.

Table No. 2.—Summary Mixture Treated Ties—Cleveland, Tex.

Kind of Wood	No. of Ties	Year Inserted	Number Removed to 12-31-32	Percent Removed to 12-31-32	Average Life in Track to 12-31-32
Hewn Sap Pine	86	1912	56	65.12	16.73
Hewn Sap Pine	116	1913	56	48.28	16.34
Hewn Loblolly Pine	78	1912	58	74.36	15.36
Hewn Shortleaf Pine	29	1912	14	48.28	17.83
Hewn Longleaf Pine	22	1912	11	50.00	16.73
Hewn Heart Pine	122	1912	28	22.95	18.28
Hewn Heart Pine	116	1913	18	15.52	18.44
Hewn Oak	50	1912	34	68.00	15.62
Hewn Gum	80	1912	21	26.25	18.34
Hewn Gum	116	1913	6	5.17	18.79
	815		302	37.06	17.87

Report on Bridge and Structural Timber

IN addition to presenting a formidable list of bridges constructed of treated wood, including particulars of their construction, that are to form the basis for a long-time service study, the Committee on Bridges and Structures, of which G. A. Haggander, bridge engineer, C. B. & Q., was chairman, presented a list of recommendations to govern the revision of timber bridge plans to adapt them to the use of treated timber. These recommendations are reproduced below:

Plans for structures involving the use of treated lumber should be prepared with a view to reducing to the minimum the expense of framing and boring the timber. The erection work in the field should be performed in complete conformity with the drawings, to insure that the assembly will be made with minimum boring or cutting of the treated material.

Framing and boring are expensive and after-treatment is objectionable from the standpoint of the life of the timber. Preframing and boring at a central point, such as a treating plant or mill, is recommended.

Timber should be purchased sized to definite dimensions to avoid a second handling through the mill. In some climates, however, it may be desirable to purchase the lumber rough and size it after seasoning to avoid irregular shrinkage.

When the character of the construction requires piles or timber to be cut or bored in the field, the plans shall specify that they should be treated in accordance with the American Wood-Preservers' Association Standard.

Holes in piling for sway braces should be pressure treated, or the holes swabbed in the field with creosote.

Stringers, caps and ties should be sized to exact dimensions and cut to uniform length before treatment to eliminate the necessity for adzing of this character after the material is in the field.

Drift-bolt holes and sway-brace holes can be prebored in the caps. It is impossible to drive all piling in exact position, but if new holes are bored, they should be pressure-treated in the field and the timber around them will usually receive some treatment from the adjacent drift bolt holes.

A lapped arrangement of stringers is recommended as good practice. It permits the construction of trestles without cutting off the ends of stringers. This arrangement provides greater bearing on the caps, eliminates cutting them to length, and provides some measure of additional strength and safety when the structure is approaching the limit of its life.

The stringers can be set up with the chord-bolt and drift-bolt holes bored before treatment, if the exact spacing of bents is known. Designs that eliminate the drift-bolts, leaving only the chord-bolt holes to be bored, are recommended. The chord-bolt holes can be bored in the field, and the holes effectively pressure-treated at the time of installation.

Ties should be of uniform depth and should not be dapped over timber stringers. They can be bored for spike holes and fender bolts before treatment. Ties on steel bridges preferably should not be dapped; they can be secured against movement by the bolts. On deck girders having various thicknesses of cover plates, ties of the standard depth can be placed on top of the cover plates, and wooden shims can be nailed to the bottom of the ties placed on the remainder of the girder. When it is considered desirable to dap ties they should be dapped so as to conform to the grade line, the dapping to be determined accurately from instrument surveys in the field, and the drawings worked out to make the proper adjustment for camber, cover plates, rivet heads, etc.

Fenders should not be dapped over the ties but should be fastened to each tie by means of lag screws. This allows them to be cut to length and bored for the necessary holes before treatment.

Timbers in frame bents, piers, trusses, draw bridge protection piers, floating sheer booms, docks, barges, culverts and a variety of other structures should be framed and bored before treatment.

The plans must not only be prepared with a view to reducing the number of holes and the amount of cutting to the minimum, but must show complete framing details of the work to be done before treatment. Each piece must be marked to show its proper position in the structure.

It is desirable to prepare plans to the end that as many pieces as practicable are alike and interchangeable. The plans should show the cuts, holes and marking of each piece of timber. They should show the exact location and the size of the holes in relation to the edges of the timber. They should show outline dimensions of the timbers, bevels of the cuts, etc. All dimensions should be to the nearest $\frac{1}{16}$ in.

Durability of Paint on Wood Treated With Zinc Chloride

F. L. BROWNE, senior chemist, United States Forest Products Laboratory, Madison, Wisc., reviewed tests made under various auspices to determine the effect of zinc chloride treatment on the durability of paint and also reported in detail on a series of tests which he had conducted in the laboratory.

The tests conducted at the Forest Products Laboratory comprised the application of various paints to 1-in. by 6-in. southern yellow pine pieces 18-in. long, grouped in series of 10 cut from the same boards. One was painted untreated, one was treated with water, three were treated to give a retention of 1.5 lb. of zinc chloride per cubic foot, three received a treatment equivalent to 0.75 lb. per cubic foot, and two were treated with a solution containing 2.4 per cent of zinc chloride and 1.2 per cent of sodium dichromate, yielding a retention of 1 lb. of mixed salts.

For exterior coatings, three common types of house paint were tested, pure white lead paint, a paint containing zinc oxide and white lead, and a paint containing titanium pigment and zinc oxide without any white lead. Each of these paints was applied in two-coat work, each was applied as a finishing coat over aluminum priming paint, and each was applied in two-coat work, using for the first coat a mixture of the paint with spar varnish. For interior coatings, lithopone paints made with a bodied linseed oil vehicle were applied; one of them was a gloss paint and the other a flat paint.

All panels painted with exterior paints were exposed on the Forest Products Laboratory test fence on October 29, 1928. They were placed on the fence facing south and sloping back at an angle of 45 deg., in which position the painted surfaces receive very nearly the maximum possible exposure to sunshine. The 20 panels painted with interior paints were exposed alternately in

rooms kept respectively at 90 per cent and at 60 per cent relative humidity for periods of one month. The rooms were interior rooms with artificial illumination only. Some of the panels were repainted at the end of 26 months, and the conclusions were based on inspections over periods up to 58 months.

Results with Exterior Painting

With all of the paints or painting procedures tested, the coatings proved measurably less durable on panels impregnated with zinc chloride (without addition of sodium dichromate) than on the control panels that had no treatment or treatment with water only. The boards containing zinc chloride were evidently more sensitive to checking, cupping, and loosening of fastenings than matched, untreated boards; when the protection furnished by the coating became inadequate, the fact was revealed more promptly by the boards containing zinc chloride. The panels that had been treated with water held their coatings just about as long as the corresponding untreated panels and were not significantly more prone to weathering. It is the zinc chloride, therefore rather then the conditions under which impregnation is effected that makes zinc chloride-treated wood more sensitive to weathering.

The impairment of the durability of coatings caused by the presence of zinc chloride was by no means great enough to render it impracticable to keep such wood painted. When it is remembered that these panels were exposed in the inclined position, facing south, which materially hastens paint failure, and that the standard of serviceableness adopted by the Forest Products Laboratory is higher than that of many property owners, the durability of paint on the panels containing zinc chloride must be considered reasonably satisfactory. The claim sometimes advanced by sellers of proprietary, water-soluble preservatives to the effect that wood treated with zinc chloride is unpaintable is unjustified.

Addition of varnish in mixing the priming-coat paint proved distinctly harmful from the point of view of durability of the coatings. It also had a tendency to cause the coatings to flake in larger patches.

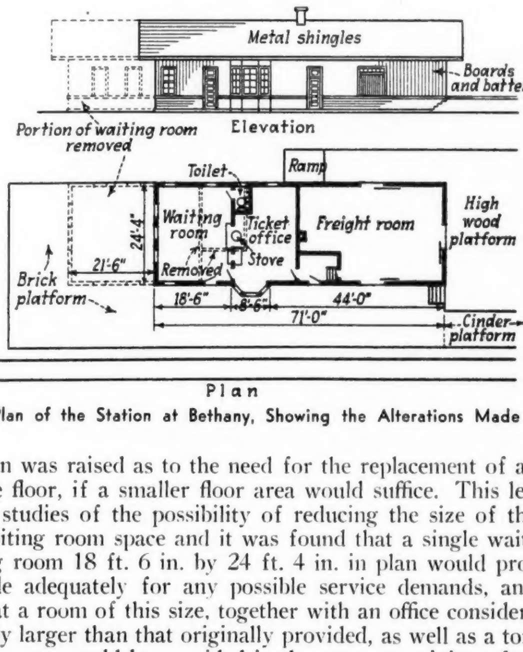
The application of the white lead paint and the lead and zinc paint over aluminum priming paint materially improved the durability and the improvement continued when the surfaces were later repainted with the white paints only. When such wood has been treated with zinc chloride it is particularly advisable to prime it with aluminum paint. It should be pointed out, however, that two additional coats of white paint will usually be required instead of one only as was done in these experiments, because it is very difficult for painters to hide aluminum paint satisfactorily with only one coat of white or light-colored paint.

The alternate exposure to 90 and 60 per cent relative humidity, to which the interior panels were subjected, was continued for about two years, after which they were kept for about two years longer in 60 per cent relative humidity. It was supposed that each cycle of this test would represent the extremes of moisture conditions to which many interior surfaces would be subject in the course of a year and that the completion of six cycles a year would greatly accelerate final failure of the coatings in integrity. There were, however, no failures in integrity on any of the panels when the tests were discontinued. These experiments, together with the survey of practical experience in industrial buildings, lead to the conclusion that, in general, treatment of wood with zinc chloride does not materially affect its painting characteristics for interior exposures

Alters Small Station to Reduce Upkeep

THAT serious consideration should be given to the possible advantage of making alterations in a building that is in need of extensive repairs is indicated by the experience of the Chicago, Burlington & Quincy, when it became necessary to replace the floor of the waiting rooms and office of the station at Bethany, Mo. This is a small combined passenger and freight station of frame construction, that had separate men's and women's waiting rooms and an office occupying one end of the building, and a freight room at car-floor level in the other end. The floors were of wood construction except that the two waiting rooms had a cement tile floor set in cement grout on a wooden sub-floor.

An inspection of the station disclosed the fact that the joists and sills under the waiting rooms and ticket office were badly decayed and required prompt replacement, but because the floor area was so much larger than necessary, in view of the decline in passenger business, a ques-



Plan of the Station at Bethany, Showing the Alterations Made

tion was raised as to the need for the replacement of all the floor, if a smaller floor area would suffice. This led to studies of the possibility of reducing the size of the waiting room space and it was found that a single waiting room 18 ft. 6 in. by 24 ft. 4 in. in plan would provide adequately for any possible service demands, and that a room of this size, together with an office considerably larger than that originally provided, as well as a toilet room, could be provided in the space remaining after cutting off 21 ft. 6 in. of the building at one end. Furthermore, it was found that it would be possible to renew the floor in this smaller area and carry out all the alterations necessary at no greater expense than that required to replace the larger floor area of the station in its original size.

While this plan did not present any saving in immediate outlay, it promised appreciable economies in operation because of the reduction in the cost of heating and in the expense for the maintenance of the building in the future. The requirements for heating were reduced not only by reason of a reduction of 43 ft. in the length of outside wall exposure, but also because the new plan made it possible to provide the necessary heat from one stove instead of two. As shown in the plan, one stove is provided in the office, being set in a gap in the partition wall between the office and the waiting room that is enclosed on the waiting-room side by a heavy wire screen.

This plan was authorized. The end of the building

was cut off, and a new end wall was built using material salvaged from the walls removed, the interior partitions were reconstructed to suit the new plan, and the floor except in the freight room was entirely replaced, using treated wood for the sills, joists and subflooring. Tile removed from old floor was relaid in the waiting room, while wooden flooring was provided in the ticket office.

More Track Awards

THE Chesapeake & Ohio, the Delaware & Hudson and the Pennsylvania have announced the results of their annual track inspections for 1933, which are abstracted below. The results of the annual track inspections on two other roads, the Erie and the Norfolk & Western, were announced in the January issue.

C. & O. Awards Cash Prizes

Cash prizes were again awarded to supervisors and foremen on the Chesapeake & Ohio as a result of the annual track inspection held on that road, a total of $1,890 being distributed among 14 supervisors and 64 foremen for excellence in maintaining their respective districts. As in the past, the inspection was made by special inspection train equipped with automatic apparatus for recording graphically track conditions with respect to low joints and cross level. For the purpose of balancing conditions in making awards, the various sections of the road were divided into five groups according to the character of the track and the class of traffic handled. Prizes of $50, $40 and $30, respectively, were awarded to the three supervisors with the highest ratings in two of the groups, while in the other three groups only first and second prizes of $50 and $40, respectively, were awarded to supervisors. First and second prizes of $25 and $15, respectively, were also awarded to the two foremen having the best maintained sections on each supervisor's territory, and two special prizes of $50 each were awarded to the supervisors whose territories showed the greatest improvement during the year. Following are the names of the supervisors who won the prizes in the five main group classifications:

Group 1—First prize—John Henzman, Charleston district; second prize—J. H. Arthur, Cincinnati district; third—W. P. Nichols, Ohio River district.

Group 2—First prize—R. R. Burchett, Barboursville district; second prize—F. P. Barrick, Paintsville district; third prize—J. F. Painter, James River subdivision.

Group 3—First prize—R. H. Gibson, Mountain subdivision; second prize—S. Ryan, Chicago district.

Group 4—First prize—H. S. Talman, Loup Creek subdivision; second prize—B. Jackson, Coal River district.

Group 5—First prize—F. A. Dirnberg, Maumee district; second prize—J. W. Knapp, Jr., Russell division.

The improvement prize awarded among the supervisors of Groups 1 and 2 jointly was won by R. R. Burchett, who also won first prize in Group 2, and the improvement prize awarded among the supervisors in Groups 3, 4 and 5 jointly, was won by H. S. Talman, the winner of the first prize in Group 4.

D. & H. Makes Track Awards

As a result of the annual track inspection on the Delaware & Hudson in 1933, 29 foremen received prize awards totaling $1,605.

The prizes awarded were as follows: First, second and third prizes of $50, $25 and $15, respectively, for the three best main-line sections on the system; first, second and third prizes of $100, $75 and $35, respectively, for the three best branch-line sections on the system; first, second and third prizes of $100, $60 and $35, respectively, for the three best-maintained main-line sections on each of the four main divisions of the road; first, second and third prizes of $100, $75 and $50, respectively, for the three best yards on the system; and first and second prizes of $50 and $25, respectively, for the two sections on each of the four divisions which showed the greatest physical improvement during the year.

The foremen winning the first prizes in the various classifications, together with their ratings, are given in the following:

Best main-line section on the system, M. Caracciolo, Susquehanna division, Afton, N. Y., with a rating of 101.77; best branch-line section on the system, J. Ruby, Saratoga division, Poultney, Vt., with a rating of 99.22; best main-line section on the Champlain division, N. DePaul, Port Kent, N. Y., with a rating of 100.70; best main-line section on the Saratoga division, F. Parillo, Ballston, N. Y., with a rating of 100.52; best main-line section on the Susquehanna division, M. Caracciolo, who, with a rating of 101.77 won the first system main-line prize; the best main-line section on the Pennsylvania division, A. Neutts, Carbondale, Pa., with a rating of 99.40. The first prize for the best-maintained yard on the system was won with a rating of 97.09, by A. Powell, on the Susquehanna division, at Oneonta, N. Y., who also won the similar prize in 1932. The first prizes on the different divisions for those sections showing the greatest improvement during the year were awarded to D. Ezzo, Champlain division, at Putnam, N. Y.; James Morello, on the Saratoga division, at West Waterford, N. Y.; Thomas Falzarano, on the Susquehanna division, at Richmondville, N. Y.; and B. Anello, on the Pennsylvania division, at Lanesboro, Pa.

Pennsylvania Commends Supervisors and Foremen

The periodic track inspections usually made by the Pennsylvania were continued during 1933, these being conducted by special track inspection committees headed by the chief engineer maintenance of way of each region. In the inspections made, each main line division, subdivision and track section was rated for line, surface and general improvement in physical condition and, as a result, letters of commendation were sent to those supervisors and foremen whose territories were adjudged the best maintained on the different divisions or subdivisions, respectively. Following are the names of the supervisors and their assistants (where they have assistants), whose territories received special commendation.

P. X. Geary, supervisor, New York division, New York zone, Pennsylvania station, New York; F. W. Artois, assistant supervisor.

Lee Spencer, supervisor, Long Island Railroad, New York zone, Woodside, Long Island, N. Y.

J. S. Snyder, supervisor, Philadelphia division, Eastern region, Middletown, Pa.; J. B. Jones, assistant supervisor.

R. H. Meintel, supervisor, Middle division, Eastern region, Huntingdon, Pa.; K. A. Werden, assistant supervisor.

J. A. Schwab, supervisor, Southern division, Eastern region, Chester, Pa.; W. H. Heims, assistant supervisor.

W. W. Boyer, supervisor, Pittsburgh division, Central region, Johnstown, Pa.; C. W. Robinson, assistant supervisor.

E. Glavin, supervisor, Eastern division, Central region, Canton, Ohio; A. Fulkerson, assistant supervisor.

J. C. Dayton, supervisor, Panhandle division, Central region, New Comerstown, Ohio.

R. W. Riser, supervisor, Cincinnati division, Western region, London, Ohio.

Phil O'Connor, supervisor, Fort Wayne division, Western region, Crestline, Ohio.

M. E. Boyle, supervisor, St. Louis division, Western region, Greenville, Ill.

D. Lewis, supervisor, Columbus division, Western region, Richmond, Ind.

What's the Answer?

Send your answers to any of the questions to the What's the Answer editor. He will welcome also any questions that you may wish to have discussed.

To Be Answered in April

1. *What are the advantages and disadvantages of self-guarded frogs as compared with independent guard rails? What are the limitations, if any, to their use?*
2. *What is the most suitable finish for wood floors in stations and offices? Why? How should it be applied? How maintained?*
3. *When renewing rail, should the old rail be uncoupled while still in the track or after it is thrown out? What are the relative advantages?*
4. *What is the purpose of camber in a bridge? Is the loss of camber an indication of distress? What action should be taken?*
5. *To what forms of misuse are adzes subjected? What are the effects? How can this be corrected?*
6. *Where sufficient silting occurs to reduce the capacity seriously, what methods can be employed to clean a reservoir and restore its capacity?*
7. *What methods can be employed to control sliding cuts? At what season should this be done?*
8. *In what way do length, depth of penetration and other local conditions affect the cost per lineal foot of piling in place?*

Jetting Piles

Should one or two lines of pipe be used for jetting piles? How should they be placed? What pump pressure should be maintained?

Generally Uses Two Lines of Pipe

By G. A. HAGGANDER

Bridge Engineer, Chicago, Burlington & Quincy, Chicago

On ordinary jetting work in sand where we want a penetration of from 20 to 30 ft., we generally use two lines of pipe, one on each side of the pile, but not fastened to it. For other soils and less penetration we sometimes employ only one jet. In some cases, the jet pipe is worked down first at the pile location to loosen the soil and make the driving easier. Ordinarily, the jets consist of 2-in. pipes, with the upper end bent into the form of a semicircle to provide a means for attaching lines. The lower end is contracted into a slit about 3/8 in. wide and 2½ in. long, or it may be a circular opening reduced to approximately 1 in. in diameter. When in service the pipes are kept moving up and down by means of blocks and falls fastened to the bend at the upper end.

Pump pressures will depend on the depth of jetting and the character of the material through which the pipe is driven, but usually ranges between 100 and 125 lb. per sq. in. For ordinary work we use a duplex reciprocating pump having a 4-in. discharge, this being of ample capacity to handle two lines of jet pipe.

We have sunk some patented jet piles to a penetration as great as 50 ft., in which cases larger pumps capable of maintaining higher pressures were required. For such piles power-driven pumps developing pressures of 250 to 300 lb. a sq. in. were employed, but these were special cases which required unusual expense for the plant layout. Our standard pile-driving equipment in territory that requires much jetting includes a jet pump mounted on either the driver itself or on an idler car where it will be readily available.

One Jet Pipe Usually Sufficient

By H. S. LOEFFLER

Bridge Engineer, Great Northern, St. Paul, Minn.

Jetting can be used to advantage for installing piles in compact soils, particularly if they contain a large percentage of sand, or of sand and gravel. Such soils do not compress easily and offer great resistance to the penetration of piles, the installation being accompanied by an upheaval of the surface of the ground in close proximity to the pile that is being driven. In some cases, the volume of upheaval is very nearly equal to the volume of the pile below the ground line. In such cases, the use of a water jet will be of great assistance in loosening and displacing the soil.

Usually, one jet pipe is sufficient. It is forced into the ground where the pile is to be driven, thereby thoroughly loosening and saturating the soil, after which it can be withdrawn and the pile driven immediately. In some soils, such as loose sand, it is desirable to use two jet pipes, placing them on opposite sides of the pile. In this event, the pile is driven simultaneously with the jetting, the lower end of the jet pipes being kept slightly ahead of, or below, the tip of the pile. If deep penetration is required, a third pipe may be used to keep the soil loosened around the upper half of that part of the pile that is below the ground line. Where a penetration of more than about 20 ft. is to be obtained in sandy soil, the jet pipe must be kept moving up and down continuously to prevent the sand from settling around the pipe, thus causing it to become stuck fast in the ground.

A water jet should consist of a straight pipe, about 2 in. in diameter, provided with a nozzle at the lower end and a return bend of about 6-in. radius at the upper end. The line used for raising and lowering the jet pipe can be attached to this return bend. The jet pipe should be connected with the water supply line by means of a wire-bound rubber hose of proper strength. The opening in the end of the nozzle should be about 3/4 in. in diameter.

In general, the water pressure will depend on the character of the soil and may range from 75 to 200 lb. per sq. in. The volume of water will range from about 75 to 250 gal. a min. Frequently, it is not convenient to provide the necessary supply of water required for jetting piles in railway structures, this being the principal reason why this method is not used more extensively.

Where the soil consists of clay, loam or other compressible types, it is generally more economical to install the piling by the usual methods without recourse to the water jet.

Emergency Stock of Treated Timber

Where creosoted-timber trestles are in service, to what extent should stocks of treated piles and timbers be kept on each division for emergency purposes?

Should Be Held to the Minimum

By L. G. BYRD

Bridge and Building Supervisor, Missouri Pacific, Poplar Bluff, Mo.

It was formerly the common practice for every division to carry large stocks of bridge material for both routine maintenance and emergency. To my personal knowledge it was not uncommon for much of this material to be allowed to remain in piles for months. In many instances untreated material so stored has decayed to the extent that it was unfit for use. With our present-day stores organization, it is unnecessary to carry stocks of emergency material on any division, although the stores department should keep satisfactory supplies at selected points where cranes or other equipment are available for loading on short notice.

Properly managed and with alert attention, such material should reach the point of use by the time the bridge gangs can be moved and organized for the work. As an example, we had a bridge 1,800 ft. long and 20 to 25 ft. high destroyed by fire. Although the nearest stock was 280 miles away, the stores department loaded the material that was required and got it on the ground by the time we were able to get the bridge gangs there. Few divisions are equipped for the quick loading of heavy timbers. Furthermore, when an emergency arises all available forces may be wanted at the point of disaster, in which event the restoration work will be undermanned if some gangs must stop to do loading, or new forces must be organized to handle the material.

It is my practice to carry a small amount of emergency second hand material with each bridge gang, ordering all material for current use as needed. In this way we have no accumulation of stock material and are saving many dollars that would otherwise be wasted by holding unused material for emergencies that may never come.

No Arbitrary Rule Can Be Laid Down

By L. H. HARPER

Superintendent Creosote Plant, Central of Georgia, Macon, Ga.

Emergencies affecting creosoted timber trestles range from a derailment that damages or destroys a few ties, to a fire or flood which may destroy an entire structure. Usually, there are sufficient unapplied timbers on a division, frequently at some nearby trestle or on gang material cars, to care for minor emergencies.

To anticipate emergencies of a more serious character, which may involve complete renewal of one or more structures, would require a relatively large stock of all standard sizes of timbers as well as piling of various lengths. This is a greater and more varied stock than it is usually practicable to carry on a single division. Where a road has its own timber-treating plant, centrally located, the problem is very simple, because there is not only a stock of treated material on hand, but usually a stock of untreated timbers and piling in the process of seasoning. The latter can often be used for driving temporary bents to pass trains over while the permanent structure is being completed.

Where there is no treating plant on the road, the next best thing is to have roadway material yards centrally located at large terminals from which several divisions can be served. Such yards should be equipped with locomotive cranes which are independent of the bridge and building department equipment, so that the work of the latter will not be delayed by having to stop and load timber. In a sparsely settled region, where the divisions are long, it may be necessary to carry a reasonably large emergency stock about midway of each division.

Like many other questions arising in railway maintenance, this is one for which no arbitrary rule can be laid down. It is a matter that must be solved in each instance after full consideration of the local conditions.

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Stone or Gravel Ballast?

What are the advantages of stone, as compared with gravel ballast for heavy-traffic lines? What disadvantages?

Stone Ballast Is More Economical

By I. H. SCHRAM

Engineer Maintenance of Way, Erie, Jersey City, N. J.

With good ballast, track can be made to ride well. With poor ballast, it is practically impossible to avoid serious damage to rail and ties; at the same time maintenance costs are increased by reason of the effort required to keep the track riding smoothly. As in other phases of track work, not only the first cost of the ballast, but the annual cost of maintenance must be considered, and all items included in determining the relative economy of two or more ballast materials.

Ballast is employed (1) to distribute the moving loads to the roadbed; (2) to support the ties and prevent longitudinal or lateral movement; (3) to provide effective drainage; and (4) to allow surfacing and lining of the track. Experience proves that crushed stone ballast of good quality meets all of the foregoing requirements. Indeed, in some sections of the country it was once thought that no substitute for stone could be provided.

Prepared washed gravel, in which the large boulders are crushed and the amount of fines, crushed material and sand content are controlled, is now available in the northeastern states and other sections of the country. This material is so superior to the run-of-bank gravel that was used formerly that its equality with stone is often suggested, particularly by producers. It is valuable in light-traffic lines and, if stone or a good quality of prepared slag is not obtainable, can be used in heavier-traffic zones, but is not the equal of stone.

Gravel distributes the load well over the roadbed if sufficient fines are present to permit good tamping. To some extent this offsets the unstable rounds which are one of the main features of gravel. On the other hand, the sharp, angular structure of crushed stone, in which the sizes are properly proportioned, performs this function much better, and continues to do so during its service life, which is longer for stone than for gravel.

Gravel is heavy and provides an excellent lateral support for the ties, while prepared gravel ballast holds it in line. It does not hold the surface so well, however, owing to the tendency of the round particles to roll out from under the ties. Also by reason of the fines that must be used in surfacing, track on gravel ballast tends to become center bound. In comparison, stone is unexcelled for keeping track in line and surface, and until it becomes clogged with foreign matter does not become center bound.

When new, gravel provides fair drainage, but because

of the presence of fines, starts with a large part of the voids already filled. This puts gravel at a serious disadvantage, as compared with stone, since on heavy-traffic lines the stack losses from modern locomotives are of such magnitude that even good stone ballast becomes clogged in from three to five years.

Track on gravel ballast can be surfaced easily with shovels, whereas power tools or tamping picks are required in stone ballast. For this reason, gravel is generally more economical on light-traffic lines. On the other hand, if the traffic is heavy, surfacing must be done at such frequent intervals that the cost advantage disappears, since track on stone ballast, if surfaced properly with power tools, requires little attention, except minor surfacing, until cleaning is necessary, at which time another general surfacing with power tools is desirable.

In general, the cost of gravel on a ton basis is less than that of stone, but requires careful checking since its specific gravity is greater, for which reason, on a cubic yard basis the cost is often much higher than is sometimes assumed. Installation costs of stone and gravel do no differ widely where equal lifts are made, as the cost of restoring the roadbed, cribbing the track, spacing ties, unloading the material and dressing the track and ballast shoulder, is about the same in each case.

Cleaning ballast is an important feature of track maintenance. On heavy-duty lines, stone must be cleaned at intervals of from three to five years and gravel more frequently. Stone can be cleaned with little loss; the loss in cleaning gravel is so great that it is current practice to discard it and apply new material. This is expensive and runs into complications at road crossings, station platforms and elsewhere where the grades are fixed.

It is obvious from the foregoing, based on the service life of the two materials, the amount of maintenance they require and the losses in connection with cleaning, that stone ballast is cheaper than gravel for heavy-duty track. In addition, gravel ballast supports vegetation more readily and is dustier than stone. It may be said, therefore, that while modern, prepared gravel is a satisfactory and economical material for ballasting track that carries light or medium traffic, it is neither as efficient nor as economical as stone for heavy-traffic lines.

Stone Is Superior in Every Way

By J. B. MARTIN

General Inspector of Track, New York Central, Cleveland, Ohio

Without considering availability, crushed stone, or crushed slag of equal quality, possesses certain advantages over gravel for heavy-traffic high-speed lines, among which are longer life; superior drainage; greater resistance to disintegration and wear from weather, traffic and tamping; and freedom from dust. Better line and surface can be maintained, shimming is eliminated and a longer life for the rail is secured.

In stone ballast the sharp angular pieces interlock to form a substantial structure having a high resistance to traffic shocks and to horizontal movement of the ties. It is clean and generally free from dust, but when fouled it can be cleaned with little loss of material. Gravel is generally dusty, does not provide as good drainage or as substantial a foundation as stone and requires more frequent tamping to maintain surface, which latter accelerates disintegration and churning.

Among the disadvantages of stone ballast are its greater initial cost and the fact that good track cannot be maintained by spot surfacing. Because of size, this ballast does not lend itself readily to light surfacing, so that to maintain good line and surface and secure maximum life from the rail, it is necessary to surface out of face periodically. Experience has demonstrated the superiority of stone ballast for heavy-traffic lines, however, with respect to both quality and economy. In making a choice between stone and gravel, careful consideration should be given to whether the volume of traffic is sufficient to justify the greater initial cost and the force necessary to surface out of face more frequently.

Stone is Superior to Gravel

By D. L. AVERY

Lead Draftsman, Chesapeake & Ohio, Cleveland, Ohio

Hard, tough stone is far superior to gravel as a ballast material for heavy-traffic lines. It has longer life, retains its load-distributing power even under frequent and heavy impact, and, if kept clean, provides excellent drainage. It does not disintegrate by reason of weather and very little from working. It is not, therefore, dusty, nor does it tend of itself to reduce the freedom of drainage. Because of its angular shape, sharp edges and varying sizes, it can be tamped into a practically immobile unit which can be depended on to give maximum support to the tie and retain the shape of the ballast section. Because of these qualities, stone ballast requires less surfacing and does not fill with dirt to block drainage as quickly as gravel. When dirty, it can be cleaned with little loss of material, so that only a small amount of new stone is required to restore the section.

While gravel has some of the same qualities as stone, it does not possess them to the same degree. Because the component materials are largely rounded, it does not interlock so well and does not, therefore, offer the same support to the ties, thus requiring more maintenance. Neither does it have as long service life, and when dirty must be discarded because it cannot be cleaned. Although the first cost is less, over a period of years it is less economical than stone for heavy-traffic lines.

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Removing Ice from Platforms

What are the disadvantages in the use of salt for removing ice from station platforms? The advantages? What other methods of removing ice are practicable?

May Cause Damage to Structures

By A. T. HAWK

Engineer of Buildings, Chicago, Rock Island & Pacific, Chicago

Considering the first part of the question first, the principal disadvantage of salt for removing ice is the likelihood that the salt brine, formed through the melting of the ice, may cause damage to some part of the structure. If the platform is supported by steel members, the damage may be severe. If the platform is of reinforced concrete, sooner or later the brine may reach the reinforcing, with the result that the metal will disintegrate rapidly. There is a wide-spread and decided opinion that the action of the brine on the concrete itself, particularly on concrete curbs, is quite injurious to the strength and life of the platforms and curbs. Obviously, if the platform is at an isolated station and is of plank construction, or is of brick on an earth fill, the action of the brine will not be detrimental.

Among the advantages of salt is its relative cheapness, the fact that it can be readily obtained, the ease of its application, and its rapid action. Salt brine does not

freeze as readily as a solution of calcium chloride, another material sometimes used for this purpose. The action of this latter chemical does not noticeably affect the platform material or steel. It costs about three times as much as salt, however. Otherwise it seems to be about as satisfactory as salt, although some users say that unless the loosened ice is shoveled off of the platform promptly it will freeze hard again in extremely low temperatures.

Ashes or sharp clean sand are sometimes used as a temporary expedient to prevent slipping on icy platforms, especially where the ice is in a very thin coat, such as sometimes forms when the temperature drops suddenly during damp weather. The disadvantage of sand is that the formation of additional ice causes it to lose its effectiveness. Cinders are objectionable because they are so readily tracked onto the floors of buildings and cars.

Should Not Be Used if It Can Be Avoided

By J. A. SPURLOCK

Roadmaster, Missouri-Kansas-Texas, Franklin, Mo.

A definite advantage, and the only one, in the use of salt for removing ice is the rapidity with which it works, thus expediting the cleaning of the platform. This is more than offset, however, by the after results, especially on concrete and brick platforms. If the brine seeps through the platform, as it is quite likely to do, it will keep the earth filling moist enough to cause the brick to settle out of surface, eventually making it necessary to resurface it, which is always expensive. A similar effect is observed on concrete curbs, since the wet condition caused by the presence of brine allows the curb to work out of alinement.

Where possible to avoid it, salt should not be used on platforms. It is better to clean off as much of the ice as practicable and then cover the remainder with a light sprinkling of sand or cinders.

Use of Salt Not Well Understood

By A. J. OSBORNE

Retired Roadmaster, Atchison, Topeka & Santa Fe, Belen, N. M.

In my experience, the use of salt for removing ice from station platforms is not well understood and is much abused. In the first place, the kind of salt provided is generally inferior in quality. I have seen enough salt used on a single platform or around a switch to care for many such jobs. Lumps as large as a man's fist and down to the size of marbles are often scattered over the ice and frozen snow by men who did not have the least idea of what they were trying to do.

Before application the salt should be pulverized. After any soft snow that may be present is removed, a light sprinkling of the salt should be applied over the ice, making sure that all of the surface is sprinkled uniformly. Throwing it down in lumps or by the handful is a waste of both material and time. Thus applied, it will hasten the melting and loosening of the ice, but will do little good until the sun begins to shine or there is a decided rise in temperature.

About the only advantage gained from the use of salt is that it hastens the melting and loosening of the ice so that it can be removed more quickly. There is a disadvantage in the fact that it starts or accelerates corrosion on the rails if any of the brine is allowed to contact with them. It leaves a whitened and streaky platform as the moisture dries out, especially if the platform is of brick. It will also have an adverse effect on the grass adjacent to the platform, if it happens to be bordered by a lawn.

Snow-Melting Cans and Torches

Where portable cans or torches burning gasoline or other volatile fuels are employed to remove snow from switches, what precautions should be taken to reduce fire and personal-injury hazards?

Principal Hazard Is in Storage

By THOMAS E. MacMANNIS

Supervisor of Tracks, Central of New Jersey, Somerville, N. J.

Where volatile hydrocarbons are used for removing snow and ice from switches, the principal hazard occurs in the storage of the supply rather than in its application by means of portable cans. Special care must be exercised at all times to protect this supply from ignition while it is stored at the point of use. More particularly, however, it needs to be well protected while it is held in storage during the summer.

While gasoline, naptha, benzine, etc., all of which have been used for melting snow, are hydrocarbons, the term hydrocarbon, as used in connection with snow melting, is employed to designate the liquid byproduct obtained during the process of manufacturing Pintsch gas. It is highly volatile, but being a mineral oil is not subject to spontaneous combustion, it being necessary to ignite it by an open flame or an electric spark.

In service, the application of the hydrocarbon is made by means of a small portable safety can, which is equipped with a long spout containing a wick, while a sleeve of asbestos is slipped over the spout near its outlet. The wick is lighted and the desired amount of flaming liquid is poured, generally in drops, at points on the rail where needed. The quantity of liquid in these cans is so small that there is little danger of fire or personal injury from their use. In fact, there has never been an accident on our road from this source.

Protection must be provided in every possible way, however, to insure the safety of the storage supply. Because of the quantity involved, the liquid would make a stubborn and intensive fire, which would be likely to endanger both the track and adjacent buildings, as well as injury to any person who might be in the vicinity. The danger of explosion of the drums is not as great as that of the possible effect of the flames. To protect against fire hazard, the supply should be stored in heavy containers meeting the specifications of the Interstate Commerce Commission for the handling of inflammable liquids. They should be tested under pressure to insure that they are free from leaks.

Open flames should not be brought near the containers. The ground around the storage tanks should be renewed before it becomes saturated with hydrocarbon as a result of spillage, since vapors that are easily ignited may rise from ground so saturated. The containers should not be more than 98 per cent full, to allow for expansion. They must be covered with dirt to a depth of 12 in. or more during the summer to protect them from the heat of the sun. I favor covering them also during the period of use, although one end and a vent must be kept open to permit access to the liquid. They should be removed from the service station as soon as the danger of snow is past and stored at some location where there is little or no hazard of fire if they become ignited. Grass and other inflammable materials should be kept cleaned away from the storage site. The containers should be inspected periodically during hot weather, and if there is any evidence of a leak the cause should be found and corrected.

Hydrocarbon is a particularly dangerous material to handle during hot weather, because it is so extremely volatile and inflammable. Heat from the sun will expand

it in the container and possibly induce leakage of the vapor, which is easily ignited. On the other hand, much of this inherent danger is eliminated by the lower temperature of the winter season, the period when these characteristics are most useful.

Much Depends on the Operator

By W. E. TILLETT

Assistant Foreman, Chesapeake & Ohio, Maysville, Ky.

Where hydrocarbon or casinghead gasoline is employed to remove snow from switches, extreme care is necessary because of the high degree of inflammability of this fuel. No torches or other open flame should be allowed near the storage supply, and the liquid should never be handled in open containers at any time, but in safety cans provided for that purpose. In preparation for use, a small quantity of the fuel should be poured on the ground and lighted with a match. The outlet of the can should then be swung into the flame to ignite the liquid as it flows out. In use, the operator should always stand on the windward side of the point of application to avoid being burned by the flame and eliminate the danger of the liquid being blown onto his clothing or the can.

Hazard Can Be Practically Eliminated

By Division Engineer

In recent years, new methods of clearing snow from switches have included the application of heat to melt and transform the snow into water or vapor. This is accomplished by means of electric heaters; through the appliction of live steam under pressure from locomotives or by means of coils laid under the turnout; by the use of low or non-volatile oils, including kerosene, through the medium of wicks or by atomizing under pressure; and by the use of highly volatile fuels, either by means of torches or safety cans, the latter being used to pour burning liquid on the snow. While there are certain risks connected with all of these methods I infer that the question refers only to the highly volatile fuels.

Hand torches that burn gasoline after it has been passed over a heated surface are in common use for many purposes. Those used for melting snow do not differ essentially, except in size, and the precautions are the same as those for an ordinary "blow torch."

One design of torch receives its supply of gasoline from large stationary containers, which are kept under sufficient pressure to insure a uniform flow of the fuel to the nozzles. The torch itself is portable, and comprises a nozzle and two lines of hose connected thereto, one for the gasoline and the other for compressed air. The oil and air are distributed from the stationary reservoirs by means of piping to fixed outlets to which the torch is attached as required, so that a single torch may be used to care for several switches. As the gasoline and air are admitted to the nozzle the fuel is atomized, and by means of control valves the flame can be adjusted to any length from a few inches to, say, 10 or 12 ft. Where this type of torch is used, the distribution lines should be provided with check valves and safety screens. The storage tank should be equipped with safety screens in the filling pipe and with a relief valve to control the pressure when the torch is in use. Because of the length of the flame, the torch should not be used when men are working around the switch.

When ordinary gasoline is poured while burning, it may be extinguished as it contacts with snow or ice owing to the sudden reduction in temperature. For this reason, some roads use casinghead gasoline, the hydrocarbon byproduct from the manufacture of Pintsch gas, etc., which continues to burn despite this sudden cooling. These are applied by means of special portable containers, usually known as safety cans, from which the burning fluid is poured at a rate that is under the control of the operator.

Obviously, ignition of such highly volatile fluids at the spout of an ordinary can would be highly dangerous, with respect to both fire and explosion. To overcome these hazards, the can should have a long spout which is fitted with safety screens to prevent the flame from flashing back into the can, and a positive-acting control valve; and a double set of safety screens extending from the filling opening to the bottom of the can. The assembly of the screens should be such that they cannot be removed except by using a wrench and by dismantling the can.

Since the switch timbers are usually too damp to ignite readily, the hazard in this respect is negligible. If the cans are properly designed and maintained, the danger of fire or explosion is so remote that I have never heard of such accidents from their use.

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Air Pockets in Suction Lines

What is the effect of air pockets in suction lines? How can they be overcome?

Grade Should Be as Direct as Practicable

By R. L. HOLMES

Engineer Water Supply, Texas & Pacific, Dallas, Tex.

An air pocket is caused by a high point, i. e., a point above the gradient, in the suction line. For this reason, all suction lines should be laid as direct as possible and on a uniform ascending grade in the direction of flow, which should be of sufficient magnitude to insure that there will be no accumulation of air at any point.

Air pockets reduce the efficiency of the pumps. If there is sufficient pressure on the pocket, because of difference in the elevation of the pump and the pocket, it may be impossible to create a vacuum owing to the expansion of the air in the pocket when the pressure is released by the operation of the pump. Air pockets that are under only slight pressure may be trapped into an air chamber and released when the pump is idle, this being done manually.

Air Pockets Reduce Effective Section of Line

By C. R. KNOWLES

Superintendent Water Service, Illinois Central, Chicago

Satisfactory operation for any pump depends in large measure on the proper installation and maintenance of the suction line. The suction line should be laid on a uniform grade where practicable. In any event, it should be laid in such a manner as to eliminate peaks or high points in the pipe line, to avoid the possibility of trouble through the accumulation of air, since such an accumulation will have the same effect as the presence of air at peaks in discharge lines. In other words, air pockets reduce the effective area of the pipe and thus restrict the amount of water that can be delivered to the pump.

While such a condition is objectionable with any type of pump, it is particularly so with pumps of the centrifugal type, since they cannot be depended on to operate properly if the construction of the suction line is such as to permit air pockets to occur. Suction lines should, in every case, be laid to a uniform grade, with the fall from the pump to the source of supply. If the grade is

uniform, only a slight fall is necessary to insure that the air will pass up through the line, to and through the pump. Extreme care should be exercised when laying suction lines, since even the slightest leak will interfere with the operation of a displacement pump, while any leak will render a centrifugal pump inoperative. Vacuum chambers are sometimes provided with reciprocating pumps, particularly where the suction lines are long or the suction lift is high, to provide a more uniform flow of water to the pump.

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Holding Track Chisels

How should a track chisel be held when in use? What are the effects of holding it improperly? How should it be struck? Why?

Chisel Should Be Normal to Surface to Be Cut

By J. J. DAVIS
Supervisor of Track, Elgin, Joliet & Eastern, Joliet, Ill.

To begin with, the handle should be set securely in the eye of the chisel. When cutting, the chisel should be held normal to the cut, to insure that a glancing blow will not result, as is almost sure to happen if the chisel is inclined. This may cause either damage to the chisel or personal injury to one of the men. Holding the chisel in any other manner is also certain to cause either a poor cut or damage to the cutting edge of the chisel.

A chisel should always be struck with a sledge, not by a tool having a hard-tempered face. Care should be exercised to insure that the striking face of neither the chisel nor the sledge becomes "mushroomed" or nicked, as splinters may fly from them when in this condition. When striking, the sledge should be brought to bear directly in line with the chisel, that is, normal to the cut. A section of air hose placed over the striking face of the chisel is an excellent precaution against personal injury, since it tends to prevent pieces of steel, which may chip off of either the sledge or chisel, from flying and striking the men.

Cut Should Preferably Be Down

By GEORGE H. WARFEL
Assistant to Executive Vice-President, Union Pacific, Omaha, Neb.

Cutting with a track chisel should always be downward, if at all possible. A chisel should be provided with a handle from 20 to 24 in. long, firmly applied, which should be held with both hands but not gripped too tightly or rigidly, to avoid spraining or twisting the wrist as a result of a glancing blow. The chisel should be held vertical, not inclined to either side; otherwise, crumblings from the cutting edge or fragments flying from the cut may result.

So far as practicable, the man holding the chisel should keep the body of the rail between himself and the chisel point. Chisels so short that they cannot be held clear of the ball of the rail when cutting downward on the flange should not be used. The striker should stand on the same side of the rail as the man holding the chisel. If he strikes right handed, he should stand to the right; if he strikes from over the left shoulder, he should stand on the left side. The striker should bring his hands down low as the blow is delivered to the chisel, so that the handle will be nearly horizontal and the sledge strikes practically in a vertical line with the chisel.

Obviously, the cut should preferably be started at the point farthest from the chisel holder, who gradually draws the chisel toward himself, each progressive movement of the chisel covering about one-half of the preceding cut and about one-half new material. Full force in striking should not be exerted until the line of the cut has been clearly defined across the surface that is being worked on. Following the complete marking, the blows should be struck with full force.

When necessary to cut from the side, as in nicking the base or marking the web or side of the head of a rail in the track, the chisel holder should stand on the side of the rail opposite the cut, and should exercise the same care to keep the chisel at right angles to the surface that is being cut. The striker must be particularly careful to swing his sledge so that it strikes in the direct line of the chisel.

Another obvious requirement is that the cutting edge be ground in perfect line with the handle and eye. It should have a head free from any mushrooming or cracking around the edge. It should be ground free of any flaking on the striking face, which should be only very slightly crowned. The sledge should have a true striking face, not worn in any direction, and should be equipped with a perfectly sound handle securely wedged into the sledge.

Improperly Held, May Cause Personal Injury

By J. A. SPURLOCK
Roadmaster, Missouri-Kansas-Texas, Franklin, Mo.

To obtain best results and avoid personal injury, it is of the utmost importance that a track chisel be held properly when in use. In fact, it is just as important in obtaining the proper cut as it is for a carpenter to hold his saw correctly when cutting a board. The correct position when making a cut with a chisel is perpendicular, and it should be moved squarely across the object to be cut as successive blows are struck.

If a chisel is held improperly, not only will the cut be bad but there is serious danger of personal injury to both the striker and the chisel holder. If it is not held in a vertical position, or rather so that it is at right angles to the surface that is being cut, it may break, chips may fly from the surface of the cut, or the chisel itself may fly out of control, any one of which is a source of danger to the workers or others that may be in the vicinity. Furthermore, a wide-faced sledge and not a spike maul should be used for striking. This reduces the tendency of the striking tool to cause the head of the chisel to burr, while it minimizes the danger in cases where splinters become detached from the chisel, as they do occasionally even where burrs have not been formed.

Should Be Held with Both Hands

By ROBERT WHITE
Section Foreman, Grand Trunk Western, Drayton Plains, Mich.

When in use, a track chisel should be held with both hands on the handle. If only one is used, the chisel cannot be held steady and the sledge is likely to glance off. The handle should be not less than 20 in. long and should fit tightly in the eye. I have observed that many trackmen prefer to have the chisel loose on the handle, stopping at intervals to drive it back to a tighter fit. This is a mistake, because if a glancing blow is struck, the holder has control of the handle only. The chisel should always be kept vertical. This aids the striker to hit it squarely, besides avoiding the probability of damage to the tool and injury to the workmen.

Chisel holders often lean to one side to make certain

that they are holding the tool straight. This is one reason why the handle should be longer than is generally used. I have often observed that after the chisel has been placed and the striker is ready, the holder will lean over to see if it is vertical. If the striker has started his swing, he may become confused, thinking he will hit the holder, so that he brings the sledge down on the rail or on a tie. The advantage of a handle 20 in. or longer is that it tends to keep the holder back from the chisel, thereby effecting a marked reduction in the hazard of personal injury.

Full force should not be used in striking until the cut has been completely defined or grooved. This groove will not only guide the cutting edge, but will also assist in holding the chisel when a blow is not struck properly. As soon as the groove is completed across the surface to be cut, full force should be exerted in striking. Short, quick striking is just lost motion, besides being dangerous, since it does not give the holder time to adjust the chisel between blows. It is the force of the blow and not the number of blows that counts, yet if the force is not controlled this may become dangerous. Strong well-directed blows are best.

I find that it is best for the holder to face across the rail in line with the cut and the striker to face along the rail. Both should not be on the same side of the rail, however, neither should they face each other.

A sledge should always be used for striking, not a maul, since the latter has too small a striking face and the face is much harder than that of a sledge. Foremen should inspect chisels before they are used and know that they are safe. I have observed cases where foremen have placed sections of air hose on "broomed" chisel heads to keep splinters from flying and injuring the men. While such a cushion is an advantage on a sound chisel, a broomed or otherwise defective chisel should never be used under any circumstances.

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Housing Switch Points

In preparing stock rails for housing switch points, should they be milled, ground or bent to shape? Why?

Grinding or Milling Give Best Results

By J. E. DAVIDSON

Vice-President, Ramapo-Ajax Corporation

For subway work, where curved switch points and high guards opposite the switch points are used because of the limited space, a stock rail with bent offset has proved to be very satisfactory when used with a heavy switch point that is not subject to feathering under service. Where high guards are not used, the offset in the stock rail must necessarily be small, usually not more than ¼ in., as an unguarded offset greater than this will cause rough riding in trailing movements.

Between milling and grinding offsets of ¼ in. or less, the only question involved is that of economy. For open-hearth stock rails, milling is the more economical process, and it can be done either in the shop or in the field, if the latter, by means of a special machine. If the stock rails are of rolled manganese steel, grinding is the more economical method.

Obviously, the design of the switch will affect the detail of the machining or grinding. A vertical cut will provide housing for a standard knife-blade switch point, which will protect the thin point to a certain extent, but an undercut bevel, with a similar bevel on the switch point, is the most satisfactory for general installation, as it allows the switch point to be thicker by the same amount as that removed from the stock rail, thus preventing the feathering or rapid deterioration of the point. This feathering or chipping of knife-blade switch points is the usual cause for making renewals.

Does Not Favor Bending

By D. L. AVERY

Lead Draftsman, Chesapeake & Ohio Lines, Cleveland, Ohio

If the housing is provided by bending the stock rail, this rail must be given a short reverse bend, and it is possible that the rail may break during the process. If it does not break at this time, excessive strains are set up in the metal, which may cause later failure in service. In any event a hazard is created and the rail will remain a potential source of danger.

Grinding is a satisfactory method when done in the shop, but is difficult to do accurately in the field. Milling is a still better method, but has the disadvantage that it must be done in the shop, preferably by the manufacturer, so that there may be considerable delay in getting much wanted material. Properly milled, the recess can be made to any degree of accuracy and will have a workman-like appearance. This method puts no internal strain on the metal, and no sharp corners or bends are left to catch the wheel flanges during a trailing movement. The rise in temperature as a result of contact with the milling tool is negligible, so the hardness and other characteristics of the metal remain unchanged. The finished rail can be delivered on the job, thus eliminating delay to the work or interruption to traffic, which may result from efforts to prepare the stock rail in the field.

No Better Method Than Bending

By A. J. OSBORNE

Retired Roadmaster, Atchison, Topeka & Santa Fe, Belen, N. M.

I do not believe that from a practical working standpoint, any better method of preparing the stock rail for housing switch points has been developed than that of bending, since it can be done in the field to meet the requirements of each particular situation. But here, as in every other operation trackmen must perform, extreme care and good judgment must be exercised, to produce a workmanlike "kink," as most trackmen call it. In the first place, a reverse bend is required and this must be located accurately, neither too far from, nor too near to the switch point.

Switch plans differ as between roads, but the bend should be sufficiently pronounced that the stock rail, after it passes the point, will diverge from a straight course and lie easily in the bed prepared for it in the slide plates. If the kink is made properly, that part of the stock rail ahead of the bend will line perfectly with the switch point and the wheels will not touch the planed-off end of the point. Neither will this rail have a tendency to bow in and ride the shoulders of the plates. Roadmasters and supervisors can find a fruitful field in educating trackmen to the proper methods to follow.

In this connection, some thought should be given to the locations where housed switch points can be used to advantage. I am somewhat doubtful about using under high-speed traffic a rail that has been given a reverse bend. They can be used to advantage, however, on yard leads and ladder tracks, where experience has shown that such use results in a marked reduction in current maintenance, the number of switch-point renewals, and in the wear and tear on switch ties.

News of the Month . . .

Eastern Lines Postpone Action on Passenger Fares

At a meeting of the Eastern President's Conference at New York on January 18, it was decided again to defer action in connection with the proposal that the Eastern railroads follow the lead of the Western and Southern lines in installing reduced basic passenger fares. The Eastern executives, after hearing the report of the passenger rate committee, decided to await further study of the results obtained by the Western and Southern roads with the lower fares. Decision on the matter was thus postponed until March.

Carloadings for First Three Weeks Are Encouraging

Railway freight traffic so far in 1934, as measured by the revenue carloading reports for the first three weeks, has shown encouraging gains as compared with 1933, and has been very near the level of 1932. For the week ending January 20, which is the latest week for which statistics are available, carloadings totaled 560,430 cars, an increase of 60,876 cars as compared with the corresponding week in 1933, and a decrease of only 2,508 cars below the comparable week in 1932. For the week ending January 13, carloadings totaled 555,627 cars, an increase of 45,736 cars as compared with the same week in 1933, while for the week ending January 6, carloadings totaled 499,939 cars, a gain of 60,470 cars over the first week in 1933.

M. P. and Santa Fe Place Orders for Rail

During the month of January two large railroads placed substantial orders for rail. The Atchison, Topeka & Santa Fe placed orders for rail totaling 34,700 tons with four steel companies and also ordered 1,600 kegs of track bolts, while the Missouri Pacific ordered 25,000 tons of rail, this tonnage also being distributed among four companies. In addition the New York, New Haven & Hartford has received a loan of $1,350,000 from the Public Works Administration for the purchase of 25,000 tons of 112-lb. rail and 10.000 tons of fastenings, to be used chiefly in the replacement of 107-lb. rail in main track between New York and Boston.

President Nominates Dr. Splawn as Member of the I. C. C.

President Roosevelt on January 8 nominated Dr. W. M. W. Splawn to the Senate for appointment as a member of the Interstate Commerce Commission, succeeding Ezra Brainerd, Jr., whose term expired at the end of the year. Dr. Splawn has served for several years as special counsel for the House of Representatives Committee on Interstate and Foreign Commerce, and in that connection has conducted several special investigations. Dr. Splawn has been examined before Senate hearings, but his appointment has not yet been confirmed.

Forecast Increased Carloadings for First Quarter

Freight carloadings in the first quarter of 1934 will be about 6.5 per cent above actual loadings in the same quarter in 1933, according to estimates compiled by the 13 Shippers' Regional Advisory Boards. On the basis of these estimates, loadings of the 29 principal commodities which constitute about 90 per cent of the total carload traffic will be 3,878,000 cars in the first quarter of 1934, compared with actual loadings of the same commodities of 3,641,416 cars in the corresponding period last year. With the exception of the Northwest board, each one of the 13 Shippers' Regional Advisory Boards estimates an increase in the loadings for the first quarter of 1934, compared with the same period in 1933.

I. C. C. to Get More Money

Appropriations amounting to $5,430,970 for the Interstate Commerce Commission for the fiscal year 1935, an increase of $240,970 as compared with the 1934 appropriation, were recommended by the appropriations committee of the House of Representatives in its report on the independent offices bill to the House on January 10. This is the amount estimated by the Bureau of the Budget. The total includes $2,526,216 for general administrative expenses, $778,888 for the Bureau of Accounts, $461,970 for safety work, $36,590 for signal safety systems, $449,606 for locomotive inspection, $1,052,700 for valuation, and $125,000 for printing and binding.

Railway Construction at Low Ebb in 1933

With only 24 miles of new line constructed in the United States in 1933, none in Canada, and 2.18 miles in Mexico, railroad construction activity in that year in these three countries reached probably the lowest level for any year since the first railroad was constructed. In contrast to the low level of construction activity in 1933, was the increase in the mileage of lines abandoned. A total of 1,876 miles of lines were abandoned during the year, which was an increase of 424 miles as compared with 1932 and the largest aggregate abandonment ever recorded in any one year. The previous record for railway abandonments was established in 1921 when 1,626 miles of line were abandoned.

Railway improvements were at an equally low ebb during the year, although work on several large projects that were started previous to 1933 were continued. These included projects totaling $182,000,000 that were carried on by the Pennsylvania during the year, and the West Side improvements of the New York Central, at New York, the total cost of which, when completed, will amount to approximately $175,000,000.

New Bill Would Regulate Bus and Truck Service

A bill for the regulation in interstate commerce of motor coach and motor truck transportation, designated as H.R. 6836, has been introduced in the House of Representatives by Chairman Rayburn of the Committee on Interstate and Foreign Commerce. The bill provides for the regulation of interstate highway transportation by the Interstate Commerce Commission, which would utilize the state regulatory commissions or boards in the administration of the act. The commission would regulate both common carrier and contract carriers as to systems of accounts, records and reports, preservation of records, qualifications and maximum hours of service of employees, and safety of operation and equipment, and with respect to common carriers would also establish requirements as to continuous and adequate service and the transportation of baggage and express. Certificates of public convenience and necessity would be made a prerequisite to the operation of a common carrier service by motor bus or by motor truck. The bill would give the commission complete power to regulate the rates of both common and contract carriers on the highways.

I. C. C. Makes Annual Report to Congress

In its forty-seventh annual report to Congress, submitted on January 4, covering the year ended October 31, 1933, the Interstate Commerce Commission, stated that before a condition of fair competition can be said to exist "it will be necessary that the various transport agencies pay the same rates of wages for comparable skill, render reliable service on a non-discriminating basis, and bear an equal tax burden." In its report, however, the commission does not make any recommendations with respect to further legislation as it has in previous years, as Joseph B. Eastman, federal co-ordinator of transportation, has these subjects under investigation and his recommendations are to be submitted to the President and Congress by the commission with its own comments. The commission also states in its report that the railway situation has improved since its last previous annual report. "With the progress of the national industrial recovery", said the report, "railway earnings have increased, railway bonds sell at better prices, and in place of the most drastic curtailment of maintenance, attention is again being given to replacing worn-out rails and equipment."

Eastman Makes First Report to President and Congress

In the first report of a series that he is to make to the President and Congress, Co-ordinator of Transportation Joseph B. Eastman recommended that the co-ordinator plan be tried for another year but with real power in the co-ordinator to issue orders unhampered by the labor restrictions of the present law, and with power, to be exercised jointly by the co-ordinator and the Interstate Commerce Commission, to enforce consolidations of railroads which they believe to be in the public interest. Mr. Eastman made it known that he is not in favor of the wholesale consolidation of railroads under present conditions, but feels that the railroad managements should be given a further opportunity to work out their difficulties with the assistance of the government.

Mr. Eastman devotes considerable space to a discussion of public ownership and operation of the railroads but feels that this is out of the question at the present time in view of the fact that the government is not now in a position financially to purchase the railroads. However, he feels that one or the other of the two remedies, government ownership or "grand" consolidation, will eventually be applied "unless the managements are able to remedy present ills in some other way."

Long Railway Bridges over the Bonnet Carre Spillway

The Illinois Central, the Yazoo & Mississippi Valley and the Louisiana and Arkansas will start work soon on bridges to carry their lines over the Bonnet Carre spillway, which comprises an important feature of the large flood protection project being carried out by the United States Government on the lower Mississippi river.

The Yazoo & Mississippi Valley structure, which will be required to cross a waterway opening 9,000 ft. wide between flanking levees, will consist of 8,000 ft. of single track, creosoted, ballasted deck trestle, with 500 ft. of embankment on each end inside the levees. The continuity of the timber structure will be interrupted at intervals of 1,000 ft. by a steel deck girder span with a concrete slab floor, on concrete piers; and concrete fire walls will be provided half-way between the girder spans for the purpose of separating the trestle into units 500 ft. long. The track will be raised 14 ft. above the level of the existing track for the purpose of providing a headroom 3 ft. above the anticipated maximum flood level in the spillway.

The Illinois Central bridge will be a double-track structure, crossing a waterway opening of 12,000 ft. between flanking levees and will be similar in construction to the Y. & M. V. bridge, except that no approach embankments will be constructed inside the levees. The track will be raised 12½ ft. above the present elevation of track, and the bridge will be located 73 ft. west of the center line of the existing tracks.

The Louisiana and Arkansas crossing of the Bonnet Carre spillway will involve the use of a larger proportion of steel bridgework, this railroad having ordered 3,600 tons of structural steel for its structure.

Association News

International Railway Maintenance Club

The next meeting of the club will be held on February 8, at the Hotel Statler, Buffalo, N. Y. John A. Reed, sales engineer of the Carnegie Steel Company, Pittsburgh, will discuss the subject of "GEO Track Construction."

Maintenance of Way Club of Chicago

George J. Diver, western sales agent for the Morrison Metalweld, Inc., was the speaker before the club at its meeting on Wednesday evening, January 24. His subject was The Conservation of Manganese Trackwork by Welding.

Metropolitan Track Supervisors' Club

The next meeting of the club will be held on Wednesday, February 28, at Keen's Chop House, 72 West Thirty-Sixth street, New York City. Neal D. Howard, eastern editor, *Railway Engineering and Maintenance* will present a paper on Ballast Cleaning Methods and Equipment. This paper will be supplemented with motion pictures of several of the latest types of ballast cleaning machines in operation.

American Railway Engineering Association

The Nominating committee of the association has nominated the following candidates for office for the year beginning next March: President, John E. Armstrong, assistant chief engineer, C. P. R., Montreal, Que.; second vice-president, A. R. Wilson, engineer of bridges and buildings, Penna., Philadelphia, Pa.; secretary, E. H. Fritch, Chicago; treasurer, A. F. Blaess, chief engineer, I. C., Chicago. In addition, Robert H. Ford, assistant chief engineer, C. R. I. & P., Chicago, is automatically advanced from second vice-president to first vice-president.

Directors (three to be elected): R. C. Bardwell, superintendent water supply, C. & O., Richmond, Va.; R. S. Belcher, manager, treating plants, A. T. & S. F., Topeka, Kan.; F. L. C. Bond, general superintendent, Central region, C. N. R., Montreal, Que.; W. J. Burton, assistant to chief engineer, M. P., St. Louis, Mo.; E. L. Crugar, chief engineer, Wabash, St. Louis, Mo.; J. A. Peabody, engineer maintenance, C. & N. W., Chicago; W. H. Penfield, engineer maintenance of way, C. M. St. P. & P., Chicago; C. C. Williams, dean, college of engineering, U. of Iowa, Iowa City, Iowa; C. A. Wilson, consulting engineer, C. U. T., Cincinnati, Ohio.

Members of Nominating committee (five to be elected): E. H. Barnhart, assistant division engineer, B. & O., Dayton, Ohio; W. S. Burnett, chief engineer, C. C. C. & St. L., Cincinnati, Ohio; H. A. Dixon, chief engineer, Western region, C. N. R., Winnipeg, Man.; Robert Faries, assistant chief engineer-maintenance, Penna., Philadelphia, Pa.; J. M. Farrin, special engineer, I. C., Chicago; John Foley, forester, Penna., Philadelphia, Pa.; William Michel, chief engineer, engineering advisory committee, Van Sweringen lines, Cleveland, Ohio; A. A. Miller, engineer maintenance of way, M. P., St. Louis, Mo.; W. A. Murray, engineer maintenance of way, N. Y. C., New York; C. B. Stanton, professor of civil engineering, Carnegie Institute of Technology, Pittsburgh, Pa.

Five committees held meetings during January, including Rail, January 4, at Chicago with 30 present; Yards and Terminals, January 16, at New York with an attendance of 22; Waterproofing, January 20, at Chicago with 4 present; Records and Accounts, at Detroit on January 25 with 13 in attendance; and Maintenance of Way Work Equipment at Chicago on January 31. A special meeting of the Board of Direction and a meeting of the General committee of the Engineering division were held at Chicago on January 30. The Committee on Iron and Steel Structures will meet at Cincinnati, Ohio on February 8.

According to the revised outline of work and personnel of committees for 1934, issued about January 20, the names of three standing committees have been changed as follows: Committee IX, Grade Crossings, will hereafter be known as the Committee on Highways; Committee XIII, Water Service and Sanitation, has had its assignment enlarged and its new designation is Water Service, Fire Protection and Sanitation; and the title of Committee XXV, Rivers and Harbors, has been revised to Waterways and Harbors. One new committee, the Special Committee on Complete Roadway and Track Structure, has been organized to study and report on complete roadway and track for various loads and traffic densities; John V. Neubert, chief engineer maintenance of way, N. Y. C., is chairman.

The list of committees shows four changes in chairmen as follows: Iron and Steel Structures, G. A. Haggander, bridge engineer, C. B. & Q., Chicago, succeeds A. R. Wilson, engineer bridges and buildings, Penna., Philadelphia, Pa.; Electricity, J. V. B. Duer, electrical engineer, Penna., Philadelphia, Pa., succeeds W. M. Vandersluis, general superintendent telegraph and signals, I. C., Chicago; Economics of Railway Labor, F. S. Schwinn, assistant chief engineer, M. P., Houston, Tex., succeeds Lem Adams, chief engineer, Oxweld Railroad Service Company, Chicago; and Waterways and Harbors, D. J. Brumley, chief engineer, Chicago Terminal Improvement, I. C., Chicago, succeeds W. C. Swartout, assistant engineer, M. P., St. Louis, Mo.

Heretofore the association has refrained from recommending standard joint-bar sections for various weights of rail. Since the adoption of the new 112 and 131-lb. rail sections, however, the Rail committee has designed a joint bar for the 112-lb. rail, drawings of which were sent to the members of the association for letter ballot on January 20. If approved by a majority of those voting before February 15, it will be submitted to the board of directors of the American Railway Association for endorsement and approval.

Personal Mention

General

Benjamin McKeen, vice-president of the Pennsylvania, and formerly engineer maintenance of way and chief engineer of the Terre Haute & Indianapolis (now part of the Penna.), has retired after having served the Pennsylvania continuously for 49 years. He was born on January 23, 1864, at Terre Haute, Ind., and was educated at Worcester Polytechnic Institute and Rose Polytechnic Institute. He entered railway service in 1885 as a draftsman in the motive power department of the Terre Haute & Indianapolis, serving successively for the next two years as a rodman on the engineering corps and as a resident engineer in charge of construction. In 1887 he was advanced to engineer maintenance of way and two years later he was appointed also chief engineer of construction. In 1894 Mr. McKeen was transferred to the operating department as a division superintendent and in 1902 he was appointed to the same position on the Pennsylvania. A year later he was promoted to general manager of the T. H. & I., serving in this position and as general manager of the successor road the Vandalia (now part of the Penna.) until 1913, when he was made general manager of the Pennsylvania Lines West of Pittsburgh. In 1917, Mr. McKeen was made vice-president in charge of real estate and purchases of the Lines West of Pittsburgh and in the following year he was appointed vice-president and engineer with the same jurisdiction. From 1920 to 1925 he served as vice-president of the Southwestern region at St. Louis, and in the latter year when the Southwestern and Northwestern regions were combined to form the Western region, Mr. McKeen was appointed resident vice-president with the same headquarters in which position he acted as the official representative of the Pennsylvania in the St. Louis territory. He held this position until his recent retirement.

Benjamin McKeen

Engineering

G. A. Phillips, chief engineer maintenance of the Lehigh Valley, with headquarters at Bethlehem, Pa., has been appointed chief engineer of the Delaware, Lackawanna & Western, with headquarters at Hoboken, N. J., succeeding **George J. Ray,** whose promotion to vice-president and general manager of the D. L. & W. was announced in the January issue. **G. T. Hand,** chief engineer of the Lehigh Valley, has assumed jurisdiction of the maintenance department and the position of chief engineer maintenance has been abolished.

Mr. Phillips was born at Dorchester, Mass., on September 28, 1889. He graduated from the University of Maine in 1911 and entered railway service in February, 1912, with the Lehigh Valley, serving successively as a levelman and transitman until September, 1915. At that time he became assistant engineer on the Seneca division, serving in that position until April, 1916, when he was appointed supervisor of track on the M. & H. division of the same road at Delano, Pa. From November, 1916, until August, 1920, Mr. Phillips was division engineer of the M. & H. division with headquarters at Hazleton, Pa., and on the latter date he was transferred to the Seneca division. He was appointed engineer maintenance of way of the Lehigh Valley at Bethlehem, Pa., in April, 1926, and in June, 1929, he was promoted to the position of chief engineer maintenance, with the same headquarters.

G. A. Phillips

Augustine L. Lee, whose appointment as engineer of bridges of the Union Railroad, with headquarters at East Pittsburgh, Pa., was reported in the January issue, was born at Richmond, Va., on February 6, 1875. He was educated in the public schools of Pittsburgh and studied civil engineering under the tutorship of his father who was a graduate engineer of the South Carolina Military College and of the Polytechnic de Ecole of Paris. In 1890 Mr. Lee entered the employ of the Homestead Steel Works and seven years later he became a draftsman for the Pittsburgh Bridge Co. When this firm was absorbed by the United States Steel Corporation in 1900, Mr. Lee became assistant manager of the Pittsburgh plant of the American Bridge Company. In 1906 he was appointed assistant engineer for the same company at its Ambridge plant. He served in this capacity until 1917 when he entered the United States Army, serving as major of engineers until July, 1919, at which time he returned to the American Bridge Company as an assistant engineer. From 1922 to 1924, he served as resident engineer for the U. S. S. Products Company in India, returning to the American Bridge Company on the latter date. Mr. Lee has been in charge of bridges for the Union Railroad since 1910. He was the engineer in charge of the reconstruction of the Monongahela River bridge of this railroad at Port Perry, Pa., in 1927. He was appointed acting bridge engineer for the railroad in June, 1932, which position he held until his recent appointment.

Augustine L. Lee

Track

C. I. Van Arsdalen, supervisor of track on the Illinois Central, with headquarters at East St. Louis, Ill., has been transferred to Effingham, Ill., where he succeeds **C. H. Behrman,** deceased.

R. W. Huston, a track foreman on the Canadian National at London, Ont., has been appointed acting roadmaster on the London division with headquarters at Hamilton, Ont., to take the place of **P. Colombo,** who is on a leave of absence because of ill health.

Lloyd E. Rodgers, general maintenance of way foreman on the Erie, with headquarters at Hammond, Ind., whose promotion to supervisor, with headquarters at Avon, N. Y., was announced in the January issue, was born on October 21, 1900, at Pulaski, Pa. Mr. Rodgers received his higher education at Westminster College, from which he was graduated in 1922. Prior to his college education, Mr. Rodgers had served as a section laborer and telegraph operator on the Erie, and a yard clerk on the Pennsylvania for a period of about two years. In 1922 he became a shipping clerk in the office of the A. S. & T. P. Company, returning to the Erie in 1924 as an extra gang clerk and timekeeper and in 1927

he was promoted to extra gang foreman. In 1929, he was appointed a section foreman and in 1932 was promoted to general maintenance of way foreman, which position he held at the time of his recent promotion to supervisor.

V. H. Carruthers, a roadmaster on the Regina division of the Canadian Pacific, at Weyburn, Sask., has been transferred to the Saskatoon division at Lanigan, Sask., succeeding **J. Karoll,** who in turn has been transferred to Weyburn. **K. G. T. Edmundson,** roadmaster at Empress, Alta., has been transferred to Manyberries, Alta., succeeding **J. P. Rogiani,** who has been transferred to Consul, Sask., where he replaces **A. Drowley.**

James Shea, general foreman at the Twin City Terminals of the Chicago, Milwaukee, St. Paul & Pacific, has been appointed acting roadmaster with headquarters at Mason City, Iowa, to relieve **C. A. Montgomery,** who has been granted a leave of absence because of ill health. **B. H. Samuels** has been appointed acting roadmaster at Channing, Mich., to replace **H. Lindeman,** who has also been granted a leave of absence.

E. L. Hoffman, a rodman in the engineering department of the Chicago & North Western, with headquarters at Huron, S. D., has been promoted to roadmaster of Subdivision No. 4 of the Dakota division, with the same headquarters, succeeding **A. J. Sorensen,** whose death on December 26 was noted in the January issue.

Mr. Hoffman was born on July 3, 1895, at Ironwood, Mich., and entered the service of the Chicago & North Western on June 1, 1914, as a rodman in the engineering department. In this capacity he served on location surveys and on various construction projects until 1917 when he enlisted in the United States Army. Following the termination of the war Mr. Hoffman re-entered the service of the North Western as an instrument man in 1920 serving in this capacity at various points until 1927 when he was promoted to assistant engineer on the Minnesota division at Winona, Minn. Following the abolition of this division in 1931, Mr. Hoffman served as a rodman and inspector on various divisions until his recent appointment as roadmaster, effective January 6.

Bridge and Building

F. E. Golladay, a general foreman in the Fencing department of the Southern, has been promoted to assistant bridge and building supervisor on the Birmingham division, with headquarters at Birmingham, Ala.

Obituary

Raymond V. Reamer, division superintendent on the Central of New Jersey, with headquarters at Jersey City, N. J., and formerly engineer maintenance of way on this road, died suddenly at his home in Roselle, N. J., on January 6. Mr. Reamer was born on November 10, 1881, at Lockport, N. Y. He entered railway service in 1901, serving consecutively to 1906 as a chainman for the New York Central & Hudson River and as a rodman for the same road. He entered the service of the Central of New Jersey in March, 1906, as a transitman and in August, 1909, he was promoted to assistant supervisor. In 1914, Mr. Reamer was further advanced to engineer maintenance of way, and in 1926 he was appointed division superintendent, in which capacity he served until his death.

C. H. Behrman, supervisor of track on the Illinois Central, with headquarters at Effingham, Ill., died on January 5.

Camilo E. Pani, executive vice-president and chief of the personnel department of the National Railways of Mexico, at Mexico, D. F., and formerly sub-chief engineer of these lines, died on December 4, 1933. Mr. Pani was born on November 2, 1868, at Aguascalientes, Aguas. He was educated in various schools in Mexico, finishing his studies at the Sheffield Scientific School of Yale University in 1887. He entered the service of the National of Mexico on January 1, 1889, as a draftsman in the engineer's office at Aguascalientes, being promoted to chief draftsman in the engineer's office at San Luis Potosi, S. L. P., in June of the same year. From March, 1890, to June, 1910, he was engaged in various phases of railway location, construction and maintenance. At the end of this period he was promoted to supervising engineer of the system, which position he held until April, 1914, when he was further advanced to general manager, with headquarters at Guadalajara, Jal. In August, 1920, Mr. Pani returned to the engineering department as assistant chief engineer, with headquarters at Mexico, D. F., and in October of the following year he was appointed sub-chief engineer. Four years later he was appointed a member of the personnel commission, and on September 1, 1925, he was advanced to chief of the personnel department. In 1932, Mr. Pani was elected executive vice-president, holding this position as well as that of chief of the personnel department until his death. From 1920 to 1924 he served also as a Mexican Senator.

Camilo E. Pani

Supply Trade News

General

The Welding Equipment & Supply Company, 2720 East Grand Boulevard, Detroit, Mich., has been appointed distributor for Universal arc welders, accessories and electrodes, by the Universal Power Corporation, Cleveland, Ohio.

F. R. Faulk has been appointed Pittsburgh district representative for the same products, with headquarters at 50 Penn avenue, Pittsburgh, Pa.

The Inland Steel Company, Chicago, has appointed **Joseph T. Ryerson & Son, Inc.,** Chicago, its exclusive selling agents for steel sheet piling in Ohio, West Virginia, Pennsylvania, New York, New Jersey, Maryland, Delaware, Vermont, New Hampshire, Massachusetts, Connecticut, Rhode Island, Maine, Kentucky and the District of Columbia. The **Pidgeon-Thomas Iron Company,** Memphis, Tenn., has been appointed exclusive agents for the sale of steel sheet piling in western Tennessee.

Personal

William I. Howland, Jr., assistant general manager of sales of the **Illinois Steel Company,** Chicago, has been elected vice-president and general manager of sales, to succeed **Edwin S. Mills,** who has resigned in the interest of his health. **Charles H. Rhodes** has been appointed assistant general manager of sales to succeed Mr. Howland. Mr. Howland graduated from Yale university in 1908, with the degree of mechanical engineer, and in the same year entered the employ of the Illinois Steel Company in the operating department. He was later transferred to the sales department, where he remained until 1916, when he was placed in charge of sales of alloy and electric steel for the Illinois Steel Company and the Carnegie Steel Company. In 1917, he entered the United States Navy and in 1919, returned to the employ of the Illinois Steel Company as assistant sales man-

William I. Howland, Jr.

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ager in the bar department. On December 1, 1926, he was promoted to assistant general manager of sales of bars, strips and alloy steels, which position he has held until his recent election.

Mr. Mills was born at New Britain, Pa., on January 5, 1870, and in 1895, entered the employ of the Carnegie Steel Company as manager of sales at Cleveland, Ohio. Subsequently, he was general manager of the Pittsburgh Steamship Company, agent of the Oliver Iron Mining Company and assistant to the first vice-president of the United States Steel Corporation at New York. From 1910 to 1919, he served as special sales agent of the Carnegie Steel Company and in the latter year was appointed general manager of sales of the Illinois Steel Company. He also served as manager of sales of the Carnegie Steel Company and the Tennessee Coal, Iron & Railroad Company. In 1926, he was elected vice-president and general manager of sales of the Illinois Steel Company, the position he was holding at the time of his retirement.

D. J. Almon, Paul Brown building, St. Louis, Mo., has been appointed district sales agent for **Morrison Metalweld Process, Inc.,** Buffalo, N. Y. Mr. Almon will represent this company in the Southwest territory.

C. B. Crockett, former secretary of the Industrial Truck Association and more recently a partner in the firm of Crockett, Lightner & Smith, engineers of New York, has become associated with the **Cleveland Tractor Company,** Cleveland, Ohio, as sales engineer. He will develop the application of Cletrac crawler tractors with necessary special equipment to the problems of maintenance of way departments, railroad shops and railroad purchases and stores departments.

J. V. Honeycutt has been appointed assistant general manager of sales and **E. E. Goodwillie** has been appointed assistant to the vice-president in charge of sales of the **Bethlehem Steel Company,** both with headquarters at Bethlehem, Pa.

Other appointments in this company have been made as follows: **F. A. Shick,** vice-president and controller; **J. M. Larkin,** vice-president in charge of industrial and public relations; and **C. R. Holton,** vice-president in charge of purchasing, all with headquarters at Bethlehem.

William Bancroft Potter, for many years engineer of the General Electric Company's railway department, died on January 15 at his home in Schenectady, N. Y. Mr. Potter had retired in September, 1930, after 43 years of service with the General Electric and the Thomson-Houston Electric Company, one of its predecessors. He was born on February 19, 1863, at Thomaston, Conn. He served an apprenticeship with several engineering companies until the summer of 1887, when he entered the employ of the Thomson-Houston Electric Company at its plant at Lynn, Mass. After a period of shop training he entered field service. In 1894, Mr. Potter went to Schenectady and the following year was appointed engineer of the railway department. In this capacity he was associated with the electrification of a large number of railway projects including the Manhattan Elevated Railway, New York, the Grand Central Terminal, New York, the Great Northern, the Detroit tunnel, the Butte, Anaconda & Pacific and the

William Bancroft Potter

Chicago, Milwaukee, St. Paul & Pacific. Shortly after 1900 Mr. Potter collaborated with others on early types of gasoline-electric rail cars for railroad use, and was also associated with the first high voltage interurban railway work in Pennsylvania.

E. J. Stocking, sales manager of the Hobbs-Western Company, with headquarters at St. Louis, Mo., has been promoted to vice-president in charge of sales. Mr. Stocking was born in Bowling Green, Ohio, in 1877, and entered railway service as a messenger boy for

E. J. Stocking

the Toledo & Ohio Central (now a part of the New York Central) in 1893. From 1904 to 1909, Mr. Stocking served in the traffic departments of a number of roads and in the latter year he became traffic manager of the Kettle River Treating Company. In 1912, he handled commercial sales for the Creosote Wood Paving Block Association and in 1915, became sales manager of the Chicago Creosoting Company. When this company was absorbed by the Central Creosoting Company in 1916, he became vice-president. In 1925, Mr. Stocking was appointed secretary of the American Wood-Preservers' Association, with headquarters at Chicago. In 1927, he became general sales manager of the Western Tie & Timber Company and the Kettle River Treating Company. When these companies and the Hobbs Tie & Lumber Company were consolidated in 1930 to form the Hobbs-Western Company, he was appointed sales manager of the consolidated organization. Mr. Stocking has been active in association work, having served as president of the American Wood-Preservers' Association in 1924, and being vice-president of the National Association of Railroad Tie Producers at the present time. Recently he has also been the representative of the crosstie producers in negotiations leading to the inclusion of the crosstie industry as a self-governing division under the N.R.A. lumber code.

B. T. Thompson, general sales agent of the **Standard Oil Company of Indiana,** with headquarters at Chicago, retired on December 30. He began work on October 2, 1884, as a messenger boy in Kansas City, Mo., for the Consolidated Tank Line Company, one of the organizations through which Standard Oil then mar-

B. T. Thompson

keted. He was transferred to Chicago in 1896 as an assistant in Standard of Indiana's lubricating department. In the 37 succeeding years he served in various capacities in that department, including those of manager and general manager. Recently he has handled the company's accounts with large corporations.

Trade Publications

T-Tri-Lok Bridge Floor Construction—The Carnegie Steel Company, Pittsburgh, Pa., has put out a 46-page illustrated booklet containing a description, service records, changes in design and engineering data concerning its T-Tri-Lok type of bridge floor construction.

Enduro Stainless Alloys—The Republic Steel Corporation, Youngstown, Ohio, has published a 14-page booklet in which are listed and described the many applications of this company's line of Enduro stainless alloys. Typical methods of installing these alloys are also described.

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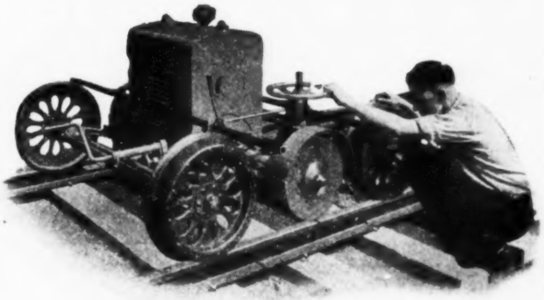

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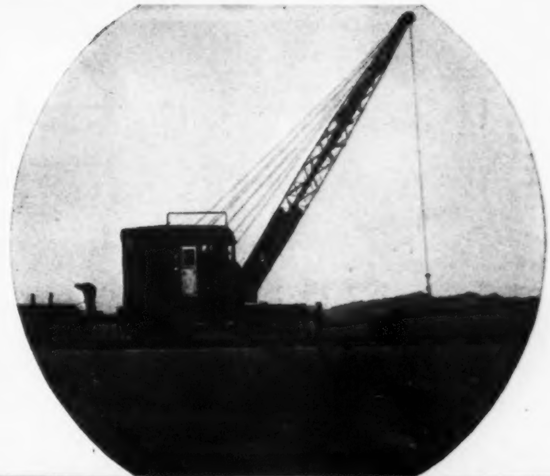

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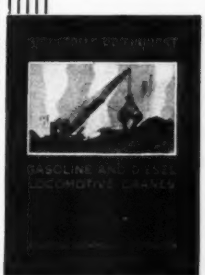

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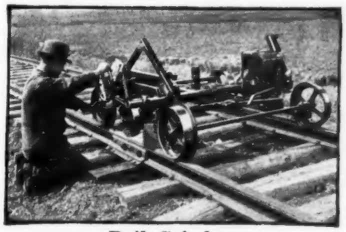
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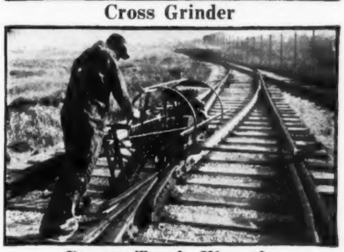
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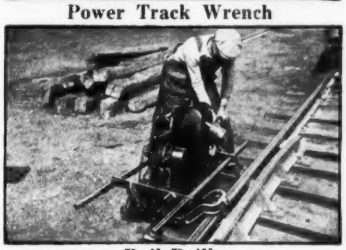
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